

3/2/53

P2

SW726 = Edwards 25. Susc. to PL722 } A4: no swarms.

A Broz env S.S.

all negative

B " a-env "

3/2/53. T.O.

C " " " + FA 54 (zeta 3+) } env sufficient to block.

3/7

D 728 → FA18 [env] 3/10: no spread! Isolate rough bud 3/15

E " " FA22 [serum] 3/15 finally grew through. →

3/6.

F 726 (FA58) -x SW666: +++ Isolate + bss. tests. aa (own)

-b +++

+b no swarms fin 726. -~~co~~<sup>coarse</sup> appearing → a. (check ax, c)  
env!

A8 P8 410

SW985

G 58 → LT-2 [1, 1, 2]

Isolate complete 3/15 still

H 58 → LT-2 [1, 1, 2]

++ +++ → env : —

3/7

3/9-10. SW985 migrated promptly through env; was immot. in a report up 985  
 2nd labo appeared → polyaggl, but ~~the~~ v. weak b, z33 +.  
 58 H1 remained immobile in env SS! (possibility of contamination?)  
 excluded later

why is 726 immotile? Note stability of H1.

3/10. Broz 726, H1 in env SS:

3/11 no swarm!

3/13 still immotile  
3/15 " " T.O.

Possibility that H1 is ab. equiv. contam? Try Phannose ferm:

LT-2: AG+

H-1: AG+

726: AG + and sparser growth. Not decisive difference. Should be repeated. (Tuy 950 - 2/1)

note "985" itself agglutinates weakly in b, z33. Reckless party  
 985 reagent was immobile in a

1026 D, E

in a serum, inhibitory state, buds from surface.



enx

Probably a spontaneous enx-a.

Check stability of these enx phases. (grow poorly on nutrient agar)

3/21.

3/13.  $\rightarrow$  726 have failed.  $\times$  typhi murium gave peculiar result (enx: -)  
 $\rightarrow$  SW666/b gave "a": -, apparently cross-reacting in b or 333.  
 (985 might be mixed). [From past experience, enx does not hinder 1,2 - etc.]

M	FA58 $\rightarrow$ SW891	$\angle 1/4$ $\rightarrow$	enx: -	after 4 <sup>th</sup> hours:
N	959	" $\rightarrow$	enx: -	still enx
O	960 slow but only, 486 $\rightarrow$	enx: -	a, (enx?)	swfug and retreat
G2	58 $\rightarrow$ SW950 (heavy FA).	$\rightarrow$ enx: -	OK, Zal -.	SW986 (22R)
G3	" $\rightarrow$ LT2	$\rightarrow$ enx: -	3/19	
P	58 $\rightarrow$ SW703 <sup>II</sup>	$\rightarrow$ enx: -		

S	sw726 $\times$ FA18 (LT2 <sup>II</sup> )	$\rightarrow$ very limited if any spread. S2 second
T	40 (sendai <sup>+</sup> )	$\rightarrow$ shows some rough blebs. $\rightarrow$ eventually 1,5: -
U	24 (703 <sup>II</sup> )	$\rightarrow$ eventually gave 1,2: 3/24
VW	55-57 (-1,2)	$\rightarrow$ (55-x) renamed 3/19: 1,2 - <sup>Rough!</sup> SW998 Try to recover smoother SW1001 isolate through SW1000

R SW985 (58  $\rightarrow$  SW666, a) /a gave a "b, 233+". S.C.-1, motility, gave same response. Also, 985, unpurified, gave similar "weak b", but did not produce a swarm through a agar. Probably initial impurity.

Thus enx of *abontus equi* is intrinsically monophasic, even when transduced to another stock.  $\therefore$  its homologies are not directly deducible.

O. 9 single colonies all a+++. 4/4 tested weak enx? Broz single colony and mass in a, enx serum. single colony and mass migrated through a, and ~~0-1~~ 0-1 not at all hindered in enx:  
 $0/a \rightarrow 1,2$  (~~enx?~~ ~~that's not it~~)

0-1/a  $\rightarrow$  1,2

Note SW726 itself was poorly motile in first transfer in motility agar.

S2 → a. 22<sup>R</sup>  
↓

exc readily. Foot place stability ~~4/5/23~~  
rather rough T.O.

and test to discriminate spont vs. transduc. origin of  
these a: exc types. Prefer smoother ab-orig strains

S. abortus equi

1026c

3/20/53. Repeat S, V, W, X (726 not  $\times$  FA18<sup>-2</sup>; 55, 56, 57 - resp.)  
but no swarms appear. Little control 726/ex.

3/27 FA18 ( ~~$\times$  TM2<sup>-2</sup>~~)  $\times$  726 gave a. = 102652 (cf D)  
E

3/29 others still invisible. See off whether swarms

D-E. Note ex → a → ex. Test diphasicity. ✓

D/ex gives scattered buds overnight, but these remain rather rough.  
E/ex goes fairly promptly. → a. and more very slowly.

∴ 1026E is now a:ex diphasic. Was this a transduction of a modifier  
or simple selection of the same?

1026D moved very gradually and slowly through ex, but these buds  
are a. Probably rather too rough.

Are these a:ex now a spontaneous ex:a or a transduction  
of a variability modifier?

3/29. 26V  
SW100# appear to be monophasic in 123.

H1  
G2  
26M      el. mix invisible → still cont! in ex  
S3 v. rough.

3/31 ex +  
i + (giant!)

Smotther cultures of ab. equi would be essential for further  
studies. (Write Morag)

3/30

18-x 726  
726 M'  
26G3 / aux still aux  
26P  
726' .  
26H1

4/3/53 ab enx (-:enx) → TM (i:1,2) gave (+:enx). SW986.

① Attempts to obtain i phase by selection have failed

② Try to substitute a subtle and distinguishable diphasic H<sub>2</sub> allele.

FB 40 (sendai<sup>2</sup>) → SW986 1 attempt → a:enx

This cannot be interpreted as sendai itself is a:1,5

③ 1026G2/enx 1 passage gave enx ++ i ++ (is slow but fully developed). This reaction also shown by single colonies.  
Possibility of i:enx:enx Compare unselected culture.  
also ab+++.

4/13/53.

Emulsion suspensions of (same rather old)

	a	i	enx
1 SW986 (stab stab)	-	++	++
2 SW986 stab	+	-	++
3 SW986B (i/enx)	-	+	++
4 SW986B <sub>2</sub> (enx/enx)	-	++	-
5 (fresh SW986-1 /enx)	-	+++	-

Thus SW986 goes through sequence:

enx(a) → enx i → i,

but relations of a reaction are somewhat obscure. Test each culture for testing.

4 s.c. i. each from (tested as a, i, enx)

	1	2	3	4
1	enx++ i+a-	do.	do.	do.

stab stab

1026H1

enx++ i- enx++ i- a-

2 a++ enx+ do. a++ enx+ a++ enx+

3 i++ enx++ →

4 i+++ enx- a- →

Recap. From FA 58 (abortus equi)  $\rightarrow$  SW950 following cultures were thus obtained,  
 4/13/53 verified by single colony tests:

	s.c.r.	alt. phase
2 SW986 (slant)	bal- or +	: a, enx
1 SW986 (stab)	bal-	: i, enx
3 SW986B = 986 (el 2 or 2?) / enx		: i, enx
4 SW986C = 986 el 3 / enx (three 2 passages)		: i
Save 1 each of these isolations for further study.		Also note.
5 = 1026e1 / enx		i.

From similar experiments, 1026e3 and 1026H1 had been isolated (both  $\rightarrow$  TM2).  
 These now react as pure enx, as SW986 was originally reported. (<sup>it could have been isolated as a strain</sup>)  
 Bal-character, even of #2 (which is the most puzzling) seems to rule out any possibility of confusion, e.g., i 1026e2 (= FA 58  $\rightarrow$  SW726). Reichen's gal character of SW726. Actually, 1026e2 shows some fermentations of EM/Bal!

<sup>-2 is weak bal+</sup> 2, thus may have been an incase in i-reaction since SW986 was first isolated. cf. 63 and H1. Said above w/ all come from single colony isolations, SW726. 3 and 4 are definitely different, presumably not mixtures or notability.

4/14. Try SW986e1 in i, 986e4 in i; 63 and H1 again in enx.

overnight

e1	i	++	$\rightarrow$ e' i - or + enx + s.c.i $\rightarrow$ UX+++ i + (delayed)
e4	i	-	{ no migr. 4/25 still very limited spread: i, no enx. - (or it
G3	enx	-	" " "
H1	enx	dense bulb	48h: slow spread. $\longrightarrow$ 4/25 : UX+ i - (v. long delay)

cf. 1039

e' indistinguishable from SW986

Thus enx  $\rightarrow$  TM makes the latter monophasic vis-a-vis either i or enx.  
 (more or less i:i!) Try  $\rightarrow$  SW950 to restore ~~mono~~ di-phasicity.

$\rightarrow$  950 shows the double reaction;  $\rightarrow$  TM more typically -:enx  
 ↴

enx i : -

cf. SW986 in i, enx serums

vs. phases of SW924 or 941

3/2/53

Non SS tubes i x s / LT22

	serum				366. 48+	H:
	FA 12	PA 22	Control motility		FA 22	
962	±	+	+	++	+	i: 1, 2
963	-	÷	-		+	i: 1, 2
4	-	÷	-		+	i
5	-	-	-	slow	irregular	b
6	++	++	-		+	gut+
7	++	++	-		+	gut+
8	++	++	-		+	gut+
9	++	++	-		+	gut+
970	++	++	-	-	+	gut+
1	++	++	-		+	gut+
2	++	++	-	-	-	gut+

970, 972 only non-motile unmotylized. Grow PA22 / 970, 972  
 (Plan FA 9 → to obtain FA 11, -?)

Single colonies of 962 were motile, <sup>miss</sup> agglutinable at first isolation  
 stock culture is actively motile!

3/6/53 ~~Also try~~ FA 9 → NM's  
 A7 (2h.) 366.

Repeat: see also 1029  
 FA 9 FA 11

B)	963	short T.	longitudinal	:
supp to	964	-		:
PAGE	965	+ short	slow	:
	966	++ T's		:
	967	T. very permanent nosw.	Tnos.	:
	970			:
	971	-	-	:
	972	-	-	:

Note: 9 → 967 filaments continue to elongate! (complementary allele of FA 9, -?)  
 Try in gum serum. (But note SW662: 553-x46 → 10)

Non Motile

1027

3/11/53.

3/6/53 9-x 967 gave a continuously extended track. Much at 8°A10, 10P10, 8P11.

3/10/53 2-x 553 } no T or S

Tubes: 9-x 553 1 Track.

2) 2-x 553 22-x 553 T+S. /gym → nosw.

Later:

sw: i

1027C1 :

s.c. i : - 3/15

3/19 gym through stiff i.

2-x 967 no T or S

9-x 967 [ numerous T+S  
numerous T no S (?)  
" T (tube) (?) ]

12-x 967 Numerous T+S.

10-x 967 numerous T, ~~swarm~~

tube 22-x 967

1 gym nosw.

later → swarm: 1027C2:

i, 967, 67 - pu + fa:

repeated 60, 67  
later i 60, 67

60-x 553

Tracks!

[ used 967M for FA60?  
canyon of FA22?  
repeat FA pup. ]

gut?

try gym on sun screen.  
SW993 (later)

60-x 967

"

(gym)  
Repas s.c. i in water  
- pu + fa gut + i

60-x 666 Sw +++ /b →

~~can't be mixed: )~~

60-x 666  
60-x 666  
gave sw.

972-x 967 T+S

970-x 967 "

970-x 972 O

972-x 970 O

Could we show that these steams are  
double mutants? Tests:

	1 (new.)	2	3	4	5	6	7	8	9	
control	-	-	-	-	-	-	-	-	✓	
970-x	+	-	=	=	+	-	+	3-4-6-8-		2
972-x	+	=	=	=	+	=	+	3-4-5-8-		3
FA22-x	+	=	++	++	++	++	++	all +		4

1	543; 616
2	5113
3	(clappr)
4	544
5	545
6	541
7	SL15
8	518 = 5?
9	549

Repeat 9-x 967: gives numerous tracks, v. rare swarms

10-x 967 " " and swarms. Need direct comparison  
of efficiencies and b: gym ratio. See 1033.

3/2/53.

= SW 979

use 732-49 unless otherwise stated. PLT-22<sup>s</sup>; strong rx in 1,5 not lw when first examined (also  $\Sigma_6$ , presumably cross-reactions).

A) Test stability in 1. sea:

1,5 benth restricted mor.

all gave swarms out.

1,5 (kb) " " later swarmed out  $\rightarrow$  lw + (phase?)

1,2,3. differing moribund, definite swarms

1,2,3 and 1,5 (benth) did not swarm pre- as allowing  $b_6$  may be prefered serum  
presumably.  $b_6$  is shortest inhibition.

N) see 1023 N However, control for N) growth in lw + 1,2

3/2 abony<sup>2</sup>  $\rightarrow$  jaijana [lw: 1,2]

3/3 2 ~~expts.~~

swarming Control fixed.

( $\checkmark$  PLT 22<sup>s</sup>) two rotatory sys, both  $a_1, b_1$   
(large  $\downarrow$  probably partially coagl) N1 N2

enx: lw  $b_p^s$  = SW 980

enx lw  $b_p^R$

eventually serum and

agg. faintly in lw, 1,5 same

7.34-0

B) FA 59  $\rightarrow$  SW 666 c/s 6 serum ++ +++ growing lit. Recover (lw) -  
(979<sup>T</sup>) SW 984. titrate c lw, 1,5!... No rx distides c 1,5  
of jaijana

c) FA 10  $\rightarrow$  SW 980 [lw; enx]

for "stable" b: enx

$\frac{1}{2} 980^1$  } numerous blbs but  
 $\frac{1}{2} 980^2$  } no extensive spread at first. ) both  
very slow spread further. ) still lw.

D) ~~980<sup>1,2</sup>~~ x FA 22 164.  $\rightarrow$  i: enx 546 is not  
E) ~~980<sup>1,2</sup>~~ x- F) 23 (faulb 6:12) 3/18: b: (immaggl!) delayed.  
F1 - still lw.

F) V. slow  
G) buds  
H) buds

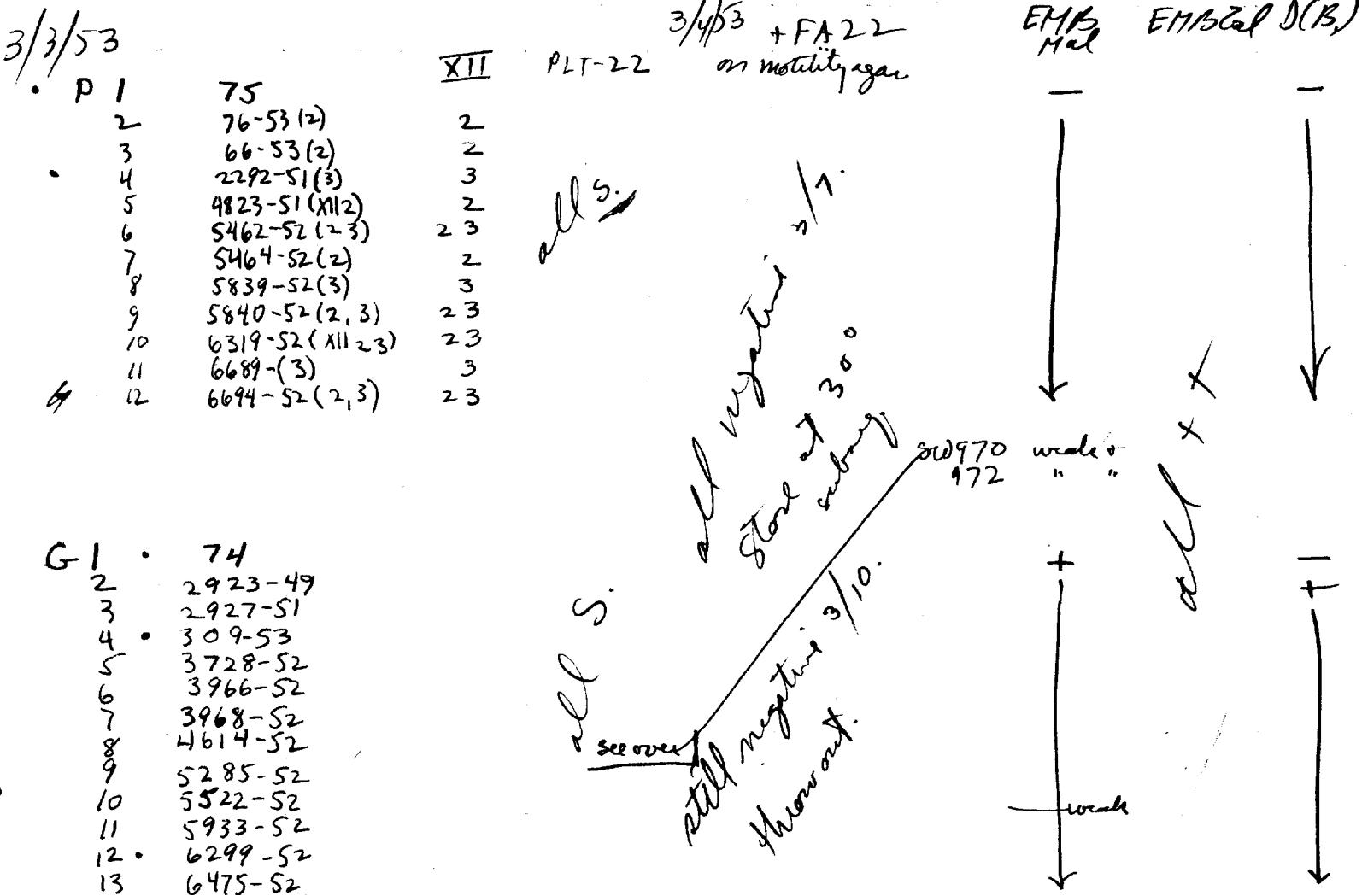
x- x- x- x-

(over)

3/29. Seal off incomplete buds of

1028:

1	$180' \times - 14$	}	<u>all live</u>
2	$' \times - 5$		
3	$^2 \times - 5$		
4	$^2 \times - 14$		
5	$' \times - 22$		



P1, P4, G1, G12 selected for further study. PLT22 grown ~~on~~ on each for FA. Twenty on SW666, EMBCal, SS.

(Stockham found PLT22/gallinarum to have v. low c.e.p. in LT-2 ( $< 3 \times 10^6 / 10^{10}$ ) or 534.)

see 1043

B. Test P1... + PLT22 for ~~gall~~ lysogeny

→ 666 EMBCal

O  
—  
—  
+  
++

A7 → 666 not.  
A8 —

P1 —

P12 —

G1 —

G4 —

FA22 + + T+S

± b: SW970 ++  
± b: SW972 +++ T+S.)

1b:

gmt SW983  
gmt SW982

(over)

hold further  
or Mal + pullum  
plan later work for  
inter-stream  
transductions.

~~28~~ ~~x FA 22~~ showed faint fuzzy  
extinction 3/10.

Renoir + FA 22 and remanubate.

ditto 972. no motility whatever to 3/19  
(probably prepautus).

~~22 -& A1~~

P1 x FA 22, 972, G4, G1      all o      n EMB/Mal.  
FA 10

~~A1~~

955 x P1 P12 control FA9 FA10      n EMB/Mal  
5    3    5    5    8

970    972    G4    G1  
8       6       5       9

no likely effect.

P1, G1 → 967, 971      all negative except a

single swarm (i flake) in ~~one~~ 1/3 Both P1 → 967 and  
and G1 → (gns) +  
plates of P1 → 967      1 each.

P1, G1 both gave tracks + occ. swarms (d) on 0901. (presumably ~~i~~)  
→ 0901 / d Both gave mag. phases that later sorted slow, i &

"autobantibod."

1030

See 1001. In FA12 → 666, b swarms were delayed relative to i!

P6. Inoculate motility tubes in 666; <sup>could not show motility diff.</sup> seems later

A7. Add  $10^{-7}$  ml SW 680, 681... 11AM 10<sup>30A8</sup>

i A. 680 / 666 mm.  
50, 53, 48, 38

B 680 / i cells. 64 = bottom = +

b C 681 / 666 61+, 60+, 64+, 66+

D 681 / - 66+

Thus 680 was stored prior to 681. (Inherent motility differences not determined: further controls needed. Differences in inhibition proximate to 666 larger not readily discernible. Use B+D as motility cultures in further rxpts.)

Remove B, D Mainly 10:40 AM 3/8 - 4PM:

B 23mm, 23	large tube	17
D 29, 28	" "	22

∴ Intrinsic difference in motility. 991C should be repeated to provide raw material comparable to 1001.

D still > B after motility selection.

3/19/53. Repeat 999C12: Dilute FA12 → SW666. (a 2-3 swarm, purple (5-10 × .01 ml samples of FA12/300). 6 early, 2 later swarms. Therefore 6: 26, 2 in 0.5 respectively. Result previously stated may have been a coincidence! - See 1001)

1 b }  
2 b }  
3 i } early  
4 i }  
5 i }  
6 i need  
7 i late  
8 b late

all 22<sup>R</sup> Test 12.

# Monopherie.

1031

A. SW 942 (N97:b-) in b SS tubes = D3 see D

Edwards dug up some other N97, "1,2" presumably. Circumstances of possible doubt as to ancestry do not rise these unless essential.

B. ① 3550-51 "b" { "monopherie" was variable. → "b+reactors, 1,2-".  
 Mor. b SS 3/13.

C. 546 in ② { single test  
 12 } immobile  
 kb: immobile  
 C2: still 1,2.

Reaction of D. 546 like agglutination  
 nearly in b (Edwards) 1:100 b  
 not b (Colindale - absorbed?) 1:  
 serum may be impure for phage  
 solution!

D. 942 in b 16 h: D3+... single colo/b. 3/10/53  
 12.3 (Colindale) - 3/12: D6 → { 233++ }  
 12-E +++ ← def. retardation? (cf. Spear's lith.)  
 Note: in tube agglutination, 942 reacts c 1,2 E (#157-serum) to >1:200, <1:800  
 c Colindale 123. 1:200++ 1:100+

E FA 54-x 666 ++. → ++ → d: (v. weak in slides) SW 987

55-x	++	-	{ repeated 3/19 is same result. Is FA 56 reactive? Tryon SW 987 Agar
56-x	-	-	
57-x	++	-	

F 959/1,2 maggl. at first, later after ss → 1,2 ++, ②++. Repass in 1,2,3  
 959/3: reactors b, also i, ??

G ~~891~~ 891/1,2 2 passes in 1,2,3 : maggl. (pr) Save and send to Edwards as B

H = 960/1,2 2 passes in 1,2,3: → still 1,2

~~5~~

12 1:100: + + +  
942: 1,5/23: -  
kb : -  
some live + <sup>few</sup> dead  
cross-reactive  
is from 1,2 only.

---

In repetitions of E, FAS6 was positive (4 control?)  
55, 57/b gave nothing (maybe useful)

56-X 967 also gave no serum.  
as H<sub>1</sub><sup>o</sup>)

Try { 55-X 967      both give + numerous serum

~~57-X~~ gives slow outgrowth at times.

gm → 57: still (gm) +

# Monophasic stability

1031d

3/7 SW942 in b SS

D.

1	{	duint fan	3/13	$\rightarrow$	$\geq 33$	v. sharp	$\rightarrow$	sci	$\geq 33:$ —	T.O 3/29
2	{	stocks	3/13	$\rightarrow$	$\geq 33$	✓	$\rightarrow$	sci		

3

4

5

3/17  $\rightarrow$   $\geq 33$

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

66

67

68

69

70

71

72

73

74

75

76

77

78

79

80

81

82

83

84

85

86

87

88

89

90

91

92

93

94

95

96

97

98

99

100

101

102

103

104

105

106

107

108

109

110

111

112

113

114

115

116

117

118

119

120

121

122

123

124

125

126

127

128

129

130

131

132

133

134

135

136

137

138

139

140

141

142

143

144

145

146

147

148

149

150

151

152

153

154

155

156

157

158

159

160

161

162

163

164

165

166

167

168

169

170

171

172

173

174

175

176

177

178

179

180

181

182

183

184

185

186

187

188

189

190

191

192

193

194

195

196

197

198

199

200

201

202

203

204

205

206

207

208

209

210

211

212

213

214

215

216

217

218

219

220

221

222

223

224

225

226

227

228

229

230

231

232

233

234

235

236

237

238

239

240

241

242

243

244

245

246

247

248

249

250

251

252

253

254

255

256

257

258

259

260

261

262

263

264

265

266

267

268

269

270

271

272

273

274

275

276

277

278

279

280

281

282

283

284

285

286

287

288

NO 31

JKL

J 891  
 K 959 { x FA15 (abund<sup>2</sup> enx)  
 L 960. } 1,2 color.  
 1,2,3  
 (2) serum. (2)

Buds + swarms in 20 hours. Fastest progressions in 1,2,3 (colonial)

! J1 b: slow → 1,2  
 K1 b: at first →  $\geq_{33}$ !  
 L1 b: (slow) →  $\geq_{33}$ !      b: 1,2 → b (single colonies next b, 1,2,3 through then)  
 (these rare).  
 Because of phasic again.      b: 1,2 → b ← Test reversibility next primarily 1,2  
 (try in b, 1,2!) of zeta → JKL, same pattern! As phase II ritually poorly  
 motile? ~~but is motile~~, pass 891... in motility agar! (31-50...):

A16 J-O moderate +.  
 K-O slow motility, gave fast bud  
 L-O moderate +.

Note 909/3 finally gave (after 2 passes 1,2,3 serum + 2 mot agar, + s.c.i.) a phase reacting, in slide aggl. b: ++  $\geq_{33}$ : ++ (i, 1,2 ± ?) in tubes at 1:1000 b++ i ± 1,2 ±  $\geq_{33}$  + ? Record as b, (i,  $\geq_{33}$ , 1,2),

SW 992 After passage through b, ~~test results b =  $\geq_{33}$~~

SW 992 J2 interpretation: Assume that b: 1,2 and 1,2 readily  
 & K3 b++ enx?  
 L2 b++ enx +++  
 L3 b++ enx ±

$\rightarrow$  gives v. slow progression  
 "agar" bands both formed, but that the b phase usually predominates.

L2 eventually Select J2, L2, L3 swarms in b: 1,2 agar to isolate. possible residual  
 thought: -: enx form. T similar sit. c d:  $\geq_{33}$  ]. No alternative phases  
 appear (already pure!) No further test except K3 enx: —

Hereafter, use motilityd J0-K0-L0 in further experiments.  
 These are still pure -: 1,2.

Try separating b from  $\geq_{33}$  colonies Record as b, ( $\geq_{33}$  ?): 1,2

(2) b,  $\geq_{33}$ , b+ $\geq_{33}$  selection?

$\downarrow$   
 $\downarrow$   
 1,2

(see over for answer)

J1': 1,2 (primarily) doubtful b mutations  
in several single colonies

Put in 1,2 serum for "  
migrates in 24h.  $\rightarrow b$ .

single colony swarmed directly through b, 1,2 but  
not b+1,2

J1' is now b:1,2 reversible.

---

Summary: 891 and 960 x abony have given so far  
only b:1,2 becoming  
diphasic.

SW959 x abony has given

(1) b:- ( $\geq_{33}$ ) <sup>might not be</sup> transduction  
(2) -: e<sub>HX</sub>

Alt phases: SW959  $\rightarrow$  959B which acts b ( $\geq_{33}$ :1,2): 1,2  
not clear whether now diphasic.

These selections need to be repeated using motilityd SW959.

3/29/53.

## STATUS.

1. 53-666-948.... (See 1008).

AEC

Combinations, tracks, etc. in progress.

L + Edwards.

W. H. Ross:

2. Monophesie 1,2's.

a) no first phases clearly produced (Reducts b from 959 - cf Edwards 1...)

b) → other stocks. Failed on above, no explanation.

Ref.

c) → 666 to reveal first phases. No swarms

0901 - Felix '30

→ 967 " " " In progress

(ex. FA.?)

959 - X abortus equi gave 1,2: - (sw1000) This is the only transduction from these monophesies. Possibly phage titers are low? Should be checked.

a) → 959-960-891... d: $\approx_6$  gave d:1,2 in each case (977 may be d: - ?) 976-8

(a): env a:1,2 SW994

b: env b:1,2

(959 seems to give stable types d: - , b: - and env). Use 959 motile further up.  
(. also  $\approx_6$ : - )

3. Abortus equi. → TM or paraB gives -:env! (SW986)

→ X ~~env~~ 960... a:1,2 ...

X 959 - :1,2

X paraB 2 - :1,2

X TM (not yet seen in control) a:env!

Need smoother culture for / with work on Olicity monophesia and (2)  
Pupae FA 9, 10, 11, 12. substituting env ...

N97b X- abony	$H_1$	$H_2$	$H_1 H_2 \times H_1 H_2$	$H_1 H_1 H_2$
	b	1,2 -	{ b - emx	b (1,2) emx
TM	b "	1,2 -	{ i - 1,2	1074 (b) 1,2 emx SW1026 SW1030 b i -
				SW1049 i 1,2 -
SW1026 X- sendai	b	i -	a - 1,5	SW1031 a b -
SW1031 altendorf	a	b -	c - 1,7	SW1052 c b
				SW1053 a c
SW1053 abony	a	c -	b - emx	a (c) emx b (a) emx
SW1049. abony	i	1,2 -	b - emx	b 1,2 - (b) 1,2 emx

1036D	N97b' $\rightarrow$ TM ✓	$b \rightarrow 1,2 \rightarrow b$	b 1,2 SW1026
	107b $\rightarrow$ mieni ✓		b - 1,5 SW1026
	(1009) 1,2 abony ✓		1,2 - emx
	SW1043? lone linda N97b 3 a emx ✓		b emx
wh. 1046.	SW1026i mieni	i 1,5	
	SW1031a SW1046	a 1,2	
	b "	b 1,2	

Recip. x — Donor

N97b  
SW1007b  
"  
SW1009b  
"  
SW1043  
=N97b

abmy  
" " " " " "

FA10 i:-  
TM  
FA10  
TM  
TM

Prod

$\text{enx} \rightarrow b$   
 ~~$\text{enx} \rightarrow 1,2 \rightarrow \text{enx}$~~

$i \rightarrow b$   
 $i \rightarrow b$   
 $i \rightarrow b$   
 $i \rightarrow 1,2 \rightarrow i$

Scw ...

1074C.

SW1026 1036E

SW1030 1038C

1038H

G

SW1049 1046C

N97b  
SW1026i,  
↓  
SW1031a  
↓  
SW1053a  
c

abmy

sensei

missor

attender

abmy

"

~~enx~~ → b

$a \rightarrow b \rightarrow a \rightarrow b$  ✓

~~enx~~

c → b

c → a

$\text{enx} \rightarrow a \rightarrow \text{enx}$

$\text{enx} \rightarrow c \rightarrow \text{enx}$

10385 SW1031

~~10386~~

1049A SW1052

B SW1053*g*

SW1054

SW1055

SW1049  
" " " " " "

abmy

$\text{enx} \rightarrow 1,2 \rightarrow \text{enx}$

$b \rightarrow 1,2 \rightarrow b$

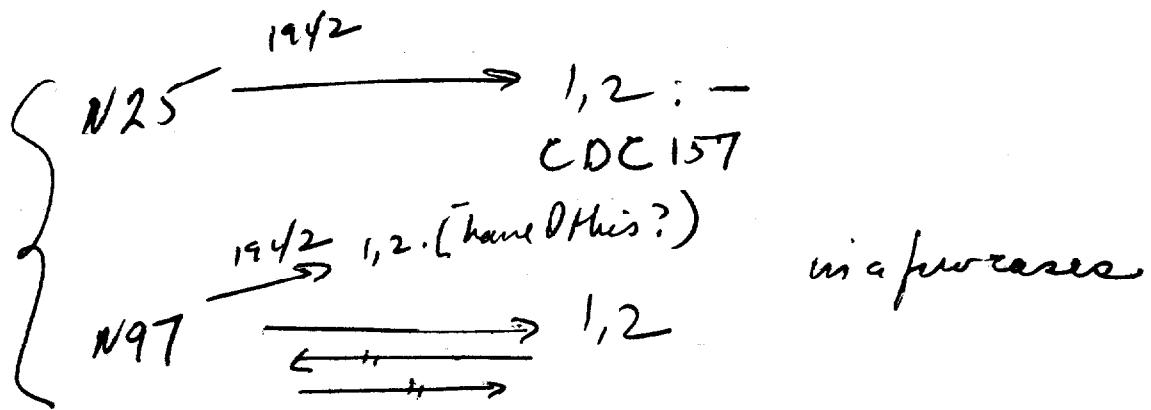
$\text{enx} \rightarrow 1,2 \rightarrow \text{enx}$

But. SW1043

1057...

SW1053 → SW666.

stated in 1948 that  $b \rightarrow 1,2$  only one  
1,2's unstable



"AMS" source of N97?

1036-1046.

233

N97

N97  $\longrightarrow$  1,2 SC  $\longrightarrow$  0  
type 3b. 1046A1

1036B1

N97  $\longrightarrow$  1,2  $\longrightarrow$  b  $\longrightarrow$  SC  $\xrightarrow{\text{SW1009}}$  0 0 0 0 0  
mess SW1009 SW1007 ~~0 0 0 0 0~~  
 $\begin{cases} \text{sc} \\ \text{SC} \end{cases} \longrightarrow \begin{cases} b \\ b \\ b \\ b \\ b \end{cases} \xrightarrow{\text{SW1009b}} 0 0 0 0 0$   
1036B1

N97  $\longrightarrow$  1,2  
mess  
SW1043

8 S.C.  $\downarrow$   
 $\begin{array}{l} \xrightarrow{\text{1,2}} \text{1,2} \xrightarrow{\text{style 3b.}} 0,0 \\ \cdot \xrightarrow{\text{1,2}} \xrightarrow{\text{b}} 0 \end{array}$

again  
 $\begin{array}{l} \xrightarrow{\text{1,2}} \xrightarrow{\text{1,2}} \xrightarrow{\text{0}} \\ \cdot \xrightarrow{\text{1,2}} \xrightarrow{\text{1,2}} \xrightarrow{\text{0}} \\ \cdot \xrightarrow{\text{1,2}} \xrightarrow{\text{1,2}} \xrightarrow{\text{0}} \\ \quad \quad \quad \downarrow \end{array}$

↑

1046B1

## History of cultures

CDC-157 = ~~S~~ para B N25 - 1,2

Hy Bull 1939 Ky Ag Exp Styr list.

[Useful to obtain a Vi<sup>+</sup> H<sup>-</sup> strain of Ty 2.]  
[Phase reversal in Ty 1.]

SW 116 = 0248 = Jersey test +.

" 5/33 - Phil offered other cultures from same outbreak.  
Received? Saved?

{ N25 } from an outbreak in C.Z. c 1942  
{ N97 } nontypable  
(Cherry)

SN25 → CDC 157 turbid pos.

{ N97 }

Some outbreaks

1025.

4.  $\pm_{33}$ . SW981 is typ.  $\pm_{33}$ : enx (Try phosphate  
SW96  $\rightarrow$  i:1,2 failed. (inadquate?) for  $\pm_{i:12}$ )

5. Monophasis 1031-36. No occurrences of 1,2 phases in available material tested. Others underway. 3550-51 (SW997); 942 gave only  $\pm_{33}$ . 546 gave nothing new. [Try to get viable 3550-51(1,2)].

6. S. javiana SW980 ✓ IX XII enx:  $\pm_{2,2}$   
996 1028F2 maggl. X—para B1.  
990 IX XII i:enx  
980  $\rightarrow$  666  $\rightarrow$   $\pm_{2,2}$ : —  
Lw seems to inhibit b.

7. Nonmotiles. See 1027. Homology tests on SW970, 972 incomplete. H, -F/a ~~in progress~~ (in progress of SW53-561-8-9 in process).

8. *Pseudomonas-gallmannii*  $\rightarrow$  0901  $\rightarrow$   $\mu_6^+$ . Other homologs not extensively tested.

9. Motility-F. 58-161 2/6 F- + P<sup>+++ Hfr?</sup> W1678 1/4 F- defective

- 10: Traits: 3/27/53 On basis of Morse' findings on synergism of Gal<sub>2</sub>  $\rightarrow$  Gal<sub>4</sub>  $\rightarrow$  +  $\rightarrow$  both Gal<sub>4</sub>, Gal<sub>2</sub>- traits may have other genotypes than receptor strain

3/10/53

(cf. Morse's contemporary experiment):

FA 22 → SW 950 as EM 13 Gal to isolate transduc. phage.

Isolate 32 papillae. After purification, grow mixed culture in LT-2 and grow phage. Assay 1 drop of each phage in SW 950 / EM 13 Gal. 1-22 individual, 23-28, 29-32 as pools.

Look for marked discrepancy as compared in SW 955 + LT2; PLT 22 + L; preparations.

	< 50	50-100	> 100	Pap./1 phage/10 <sup>7</sup> ratio
#:	9	13		A1 88/31 773 d <sup>+</sup> 69
	8	22		A2 241 1251 • 193
	7 (2)	11		A3 73 576 • 161
	6			A4 296 1456 • 204
	15		18	FA 22 144/231 1448 • 160
	19			late platings ↗ too high for accurate count!
	20			
	21			
	5			
	76			
FA 22				
	11			
	14			
	1	(0)		ratio is fairly good,
	29+			constant accord; about
	23-28			1.75 transductors per 10 <sup>7</sup> φ.
	10			Earlier determinations for this
	955			factor, which is fairly meager
	4			
	3			
	2			
	12			

Some of these are very crudely estimated. Save nos. 11, 22, 23, 7 for further assay as 1032 A(1-4). Assay φ, FA Gal +. Also pass papillae further test of same sort.

Note: Despite semi-bystander  $\text{CHCl}_3$ , the phage became obviously contaminated, presumably in LT-2. This is apparent in terms of overnight papillae. A 2-3-4 show this property. Initial readings, however, are probably OK, so repeat assays after incubating and shaking in chloroform in closed vials.

(over)

169  
 193  
 161  
 204 } *transductions*  
 per  $10^9$

160

Repick 4 papillae from A4 = B1-4 for second pass  
Assays, .1 ml  $\rightarrow$  SW950

B1 315  
 2 352  
~~4~~ 307  
~~3~~ 480

3/27/53.

~~Repick 4 papillae from~~ Pick 4 papillae fr C.

1/7/53. C1 57  
 2 131  
 3 116  
 4 3 (probably nonlysog.)  
 FA 22 113

no efft lysis. Note vanetox in assay  
 (little rare or indicator).

Isolate C2 and save.

10326

SW684 is sole balv

K. SW684. Salt+ colony (isolated by HLM, must be balv) + culture  
buffed. But in first test lysozyme  $\infty$  Salt+! / SW668.

ff973<sup>B</sup> K<sup>1</sup>  
K<sup>2</sup>.

L. Reisolate SW684 balv.

not recoverable 4/53.

3/19/53

y. 1027

FA22 → SW967 /gm. → after 48-72 hours swarms: again c.  
Unless 2-step transduction is involved, which seems doubtful, SW553  
also shows limited transduction.

Recapit.: 1. SW967; 553 → SW666 docozine F/q<sup>+</sup> b and gm.

[Compare b:gm ratio with  
N.Y. and motile SW967...]

2. SW666 → SW967 gives (only?) gm

3. ~~F~~ LT2 → SW967 gives mostly gm. selectively.

[Unadjusted ratio gm: i.]

[b from 666 → 967? Note  
rarity of any swarms.  
cf. swarms: trunks 666, 666F6]

- |              |          |   |                  |  |
|--------------|----------|---|------------------|--|
| 4. FA9 → 967 | 5/5 gm   | save 2 22 <sup>s</sup>                          | <u>1. SW1045</u> | Review some of<br>these for sensitivity to |
| 5. 12 → 967  | 6/6 gm   |   |                  |  |
| 6. 10 → 967  | 54/54 gm | save 2. 22 <sup>s</sup>                         | PLT-22           | for further                                |
| 7. 22 → 967  | 67/71 gm | 2i 2 rough. { 49<br>2i } save 6 22 <sup>s</sup> | tests.           |  |

Thus confirm occurrence of "limited" transduction.

Activities of suppressed phage:

- |                 |               |                |
|-----------------|---------------|----------------|
| 8 FASS (SW959)  | - gm          | + gm in excess |
| 9 56 (SW960) {  | → SW967 + gm. |                |
| 10 57 (SW891) } |               |                |

9. 3/19: → SW666 ± b. 55, 57 gave swarms & but  
not c b, cf. 1031 E

JAN 25 1955

TS 58 = shorties gear  
supposed to be H,  
but to use SW 1067  
which may actually be H.

F19, ... : Track segregation

3/29/53 (666)  
A. FA9 → SW967.

(609)  
B. 10 → 967

(623)  
C. 12 → ~~12~~ 666.

D. FA60 (SW967) → SW666.

3/30. A has almost no Trks. (new pup. of FA9, may be too late)

3/30. Repeat B,C,D 10 AM.

B. Most plates too hairy : isolate tracks

B. Pick b. #6 shows a few motile cells - esp.

(and puny, punier.) from 1' plate

Repurify all b, but test 1-5 also directly

C, D. Too hairy

in FA(?)8. (1-5) x 58 → gms, not b. Also test each x 60  
6 x 22 → gms not b #3?

72 tested others 3m.  
all → gms + ~~5 good + #3~~

A. After 24 hours tracks appear. Pick 17. Spot on SS ± FA22.

3/31. Repeat A 9<sup>30</sup> AM. Use 928 Lwoffate → SW967. 30 plates picked

B 10A → 967 33 picked #7-#9.

C 12 → 666 ± b, i serum

D 60 → 666

E 60 → 948

F 9 → 948

G 10 → 948

H 22 → 948.

4/1 and 4/2 A. After 15 hours, tracks and swarms are completely inhibited by gms serum. Swarms are reduced in number but tracks are scarcely affected (number) by b serum. In serum, tracks and swarms are very profuse. Pick tracks away from vicinity of swarms

C. Tracks are not very numerous compared to swarms. In b, i serum numerous swarms (somewhat reduced?); no tracks at all. b+i: a few inhibited swarms No tracks that could be isolated.

B. Dilute plating. Pick isolated occasional tracks

What was 1033 next? (1) look for crossovers  
(2) serum effects

JAN 24 1955

A:  $(SW666 \rightarrow SW967)T \times FA22$  all gm (17 tested)  
all ~~+~~ FA60.

S. 50: all gm

B  $(SW609 \rightarrow 967)$  (much heavier yield than A).  
 $T \times SW726$  or TM2  $\rightarrow$  6 all gm.

No record of  $Fla_x$  derivatives, but note to do it.

Reprinted. i serum test. i gm serum, no T or S from A.

no effect of  $\leq$  serum.

(cf  $b \rightarrow i'$ )  
(Dorgm  $\rightarrow b$ )

C.  $12 \rightarrow 666$ . Note that  $T \approx S$ . No i inhibited T.

D.  $(60 \rightarrow 666)^S T(4) \times TH2 \rightarrow b.$   
 $6b, 4gm$

E. Found that  $(948 \times PMO)T$  was more susceptible of transduction:  
T:S ratio here is 120:10

D. Occ. tracks and swarms. Pick as possible. + FA 22 4/tracks  
 $\frac{6}{b}$   $\frac{4}{gms}$ .  $\downarrow b$ .

E. No swarms, rare tracks  
 $E1 \pm 22$  several tracks, no sw.

$E2 \times - FA 22$

F. No swarms or tracks (smeared)

G. Rare tracks  $G1 \times$  - methods  $G2 \times$  +++  $G2, G3 \times - FA 22$

H. Rare tracks  $H1, H2 \times - FA 10$  rare tracks.

A 1-17 tested  $\times - FA 60$  (Sw967) No swarms. All tracks are  $22^S$   
 $(1$  self-phaged)

$Y G2, 948 \times - FA 22$  for off. transduc, etc. 948, G2 both  $22^R$ .

G2 may carry some  $q$  / Sw950?  
 $(\circ$  small plagues)

[Text  
A (original) 50 swarms all gms, no b.  
cf. D.  $6, 22^R: 44, 22^S$ ]

set up FA 22 2: Sw948, G2 1. One .02ml samples on mot agar.

18 hours:  $\rightarrow 948$  no T or S this time.

$\rightarrow G2$	T	S
	28	5
	47	3
	45	2
		+
120	10	(all a)

G2 is apparently selected  
as more amenable to transduction,  
(XII form variant ??)

Possibility that G2 has had a substitution of Fla, -? But derived from  
FA 10  $\rightarrow$ .

Serum reacted Typhi murium O 1:2", presumably absorbed on typhi, but found to react c. abattoirid LT-2, not D901. (concluded by CES "1x only D", presumably incorrect).

In slide tests, stock cultures of attendorf, zeta, <sup>sandiego</sup> were not agglut. but abortus equi (though already rather rough) was distinct c. abortus equi and sandiego.

Use 2 ml SS agar + .05, .1, .2 ml O serum. (presumably mostly IgG)  
3/4 None inhibited.

---

Fry LT-2 in ~~adult~~ ~~serum~~

abmy x FA60, FA61 and control in 2 ml serum / ca 4 ml SS.  
control (polished surface) swarmed nicely through overnight.  
A/B expts had gone ca 2 cm in 24 hours. Seal off this and  
also remeasure

A: 4/4 still 00+ T0 -

B: 3/3 rather rough, but B+T-

D901 T+ B-

Results unambiguously negative

3-20-53. Motilize abony 1 and 2. Prepare FA 14C and 15C resp. from single colonies.

Plating of lysate before heating showed: 14C 24 b : 1 enx colonies  
15C 0 b : 20 enx

These FA should behave substantially pure.

Prepare suspensions of TM2 and SW950, phases i and 1,2 from single colonies.  
Plate mixtures with FA on 1:12 serum SS agar.

A. SW 950 (i) + TM2 (1,2) x-- 14C [b:enx]

.1 ml 1:1 culture mix + ~~x~~ .2ml FA  
pipette spread.

B. i- 12+ x-- 15C b:enx

10A27: All plates rather overspread  
(medium still too moist; insuff.  
antiserum?)

C. SW 950 (12-) + TM2 (i+) x-- 14C

D. x-- 15C

Pick whatever swarms as possible, and stationary growth ( $A_0$ ,  $B_0$ ...). Streak these out as well as inocula.

	gross slide agg.		Colonies on EMB Gal
AB inoc	i++	12++	- = +
CD inoc	" "	"	- = +
Ao	i+	12++	ca 5+:1-
Bo	+	++	3+:1-
Co	++	++	+==
Do	++	++	+==

	Individual colonies		
5+	all 12	5- all 1	all ok/
	"	" all 12	
	all 12	all 1	ok
	4:1 1:1(12)	"	
5 i:4 i:1(12)	all 1:12	?	
5 i(12)	all 1:12 !	?	

Co and Do reacted very poorly directly from colonies and were therefore reinoculated into broth and then tested. It is still mysterious that they should show this diphasicity. Restreak and cf. C-D inoculum.

In first run, A and C gave discrete swarms; B and D were badly overspread, and must be regarded as pooled (and possibly biased) swarms.

A: 1-5 all Gal- b

These are in agreement with result of 979JK,  
and may also show directive preference of  
recipient phase (homophasic)

C: 1-3 Gal+ b

B: 1	Pred. Gal- (5/5 b); few + (5/5 enx)	Count 1 b-	1 enx+
2	almost pure Gal+	5/5 enx	"
3	pred. Gal + (5/5 enx); few - (5/5 b)	"	"
4	pred. Gal+ (2/5 enx 3/5 12*)	- 5/5 b	"
		<u>3 b-</u>	<u>4 enx+</u>

D: 1-3 All virtually pure Gal+ b.

3 b+ .....

P28

Rerun B,D using smaller inocula (same suspensions). Still overspread, but mod. well isolated swarms.

B: 2 Gal- b : 2 Gal- enx [sic]

D: 11 Gal+ b : 2 Gal+ enx : 1 Gal- enx

Total	homoph b	heteroph b	homo enx	heteroph enx
A	* 5	-	-	-
B	* 5	-	* 4	2
C	* 3	-	*	-
D	14	-	*	2

4/8/53

See → for  
summary.

FA15C → TM2

1 swarm: enx

2 7 swarms: enx

(old suspension) v. dilute FA. well-isolated swarms.  
(This fits previous data much better.)

4/10 ... FA15C

mixture

5 swarms: enx

dil. → AB

(several)

gal: 3+ : 2i

35B'

$a = gal + -$

$5+ = 1, 2$

$5- = i$

(homog) (heterog)

(cf 4:2 previously!)

35D' comparable to above. discrete swarms only.

+ plate more heavily inoculated → pool

4/13.

noz CD streaked out. random Gal+

$5+ \{ \begin{matrix} 1 \\ 4 \end{matrix} \begin{matrix} i, 1, 2 \\ ; \end{matrix} + -$

if AB  
Dinoculum?  
These are much  
more motile

$5- \{ \begin{matrix} 5 \\ 1, 2 \end{matrix} \begin{matrix} i \\ ; \end{matrix}$

15C → CD. Discrete swarms:

75b all Gal+

9 enx 3 Gal-

6 Gal+

These mixtures are  
peculiar. Save  
as 10<sup>3.5</sup> C, D, CD.

D: pool, streaked out ca 10 Gal+ : 1 Gal- . pool mass wants b,

Picks 10- enx

10+ b

C-D show the major discrepancy. Possible sources of error:

1. Inanity of FA. (in spite of preliminary control!) Repeat with other pups.
2. Intrinsic motility difference favoring Bal+ cells. But cf. A.
3. Differential effect of the serum preparation, favoring B: - over env.
4. Cf. peculiarity of phase of C<sub>0</sub>-D<sub>0</sub>!
5. Contamination of FA15 with abox. (Test some D for phase 2) but B is also descupant. Not likely.

2) 2/12/53.  
More AB<sub>0</sub> or CD<sub>0</sub> or / mot agar  
At margin, streakout: AB pure + (1,2)  
CD ~~pure~~<sup>20:</sup> + (1,2)  
Try T0<sub>2</sub> through motility agar: 2 passages reacted 1,2++ i -  
∴ phase 2 is more motile.

In streaks of s.c.i. from A-B-C-D mice,

95D(1,2) showed mixed culture in broth from each of two  
A-C., no others.

E. 4/8/53. Test quality of FA15C, at dilutions to permit discrete swarms.

$\rightarrow TM^1$  1 swarm enx Same susp. as 1035.  
 $\rightarrow TM^2$  7 " enx.

B' 4/11 FA15C  $\rightarrow$  AB. 5 swarms: all enx, 3 Gal+  
Control AB 5 Gal+ : 1,2  
5 Gal- : i

D' 4/13. same suspensions, diluted FA.

FA15C  $\rightarrow$  C (SW950<sup>2</sup> + TM<sup>1</sup>)

Control: random Gal+. [ 5+ : 4 i 1 i, 1,2.  
5- : 5 i+1,2

Discrete swarms: 25 b all Gal+  
9 enx 3 Gal-  
6 Gal+

cf. 3/28 D - quite homogeneous.

pooled swarms, ca 10 Gal+ : 1 Gal-

10 Gal- : 10 enx

10 Gal+ : 10 b.

Thus if we regarded Gal- only (= 1,2, in this case) all would be homophasic, but 25:6 of the Gal+ (TM<sup>1</sup>!) are b. Swarms may have been too crowded still. TM has not, as a rule, given any difficulty in scoring i vs. 1,2 but should be examined further.

Currn. totals (discrete swarms only):

\* homophasic

		Gal+ b	Gal+enx	Gal- b	Gal-enx
A	i - plus 1,2 +			5	
B				2	2
C	i <sup>2</sup> plus 1,2 -	3	•		
D	<del>i<sup>2</sup></del> plus 1,2 -	36	8	4	•
E	1,2 +		7		

See 1037 for further analysis of TM; SW950.

3/26/53.

see 1031

- A. "7-119" from Cheung 2/53. "Peters Serum Co" Shipy Nov. 1942  
*S. paratyphi B* type 3b. Monophs. nonsp. testate +.

= SW 1006.

SS = ~~amino acid~~ <sup>original + bicarbonate</sup> for my hands - rather rough. Rapid smooth colony for stocks.  
 It - agglutinable. Does not swarm through SS agar either  $37^{\circ}$  or  $30^{\circ}$ .  
 Microscopically: occasional cells (ca  $10^{-4}$ ) show definite motility,  
 others stationary. Some diffusion in SS, but no progressive  
 swarms or blebs. This abd. stationary under microscope. (anti. ag. for  
 motility?) Chills with Cheung. On SS plates, numerous blebs appear,  
 enlarging to swarms which are markedly inhibited near margin - probably  
 accounting for failure in SS tubes which were more restricted. (Antibody  
 system?) 2 swarms: 1, 2 ++, b ±. A smooth-looking colony (s  
 SS solution) was actively motile. Note: self phagocyt!

B N97 "A.M.S. Some unknown type 3b Monophs. sp. testate +"  
 ✓ agglutinable in b. ~~that's what for single colonies & no. 6 serum.~~  
Stocks: grew through b in 48 hours (after def. inhibition) =  $36/31 = 1, 2 -$   
~~SW 1009~~  
~~otherwise 3/29.~~ N97 org lost. Put mass 36/31 through  
 SW 1007 (recovered from mass 1036B1) = b. for residue <sup>1, 2, 3</sup> N97, many.  
 Shoot out and test single colonies in b serum.

4/5. 1036B1, s.c., also gave b after prolonged incub in 1, 2, 3  
 ∴ N97 is reversible b:1, 2. (and fresh isolate of pure N97)

C. "N97 (3) 1" java nsp. Grew very slowly in Peassay or  
 nutrient. Test swam through ammonium. 1, 2

NOTE.

SW1007 (= N97 or ?), and most other b phases  
exact  $b++z_{33}^-$  (including SW1027, 942,)

SW1009 = N97 ph. 2 = 1, 2, not  $z_{33}$ .

SW1009  $\rightarrow$  SW1009b (ph. 1?) but this is  $bz_{33}$ .

In 1036 G, the b phases are all from a single ~~one~~ solution of  
SW1009 1, 2, 3 and are evidently all  $bz_{33}$ .

For comparisons, F1-F5 should be compared. F1b is recorded as  
being  $b++z_{33}^-$

SW1009b (b1) does not revert to 1, 2, 3... but slowly gives  $z_{33}$ .

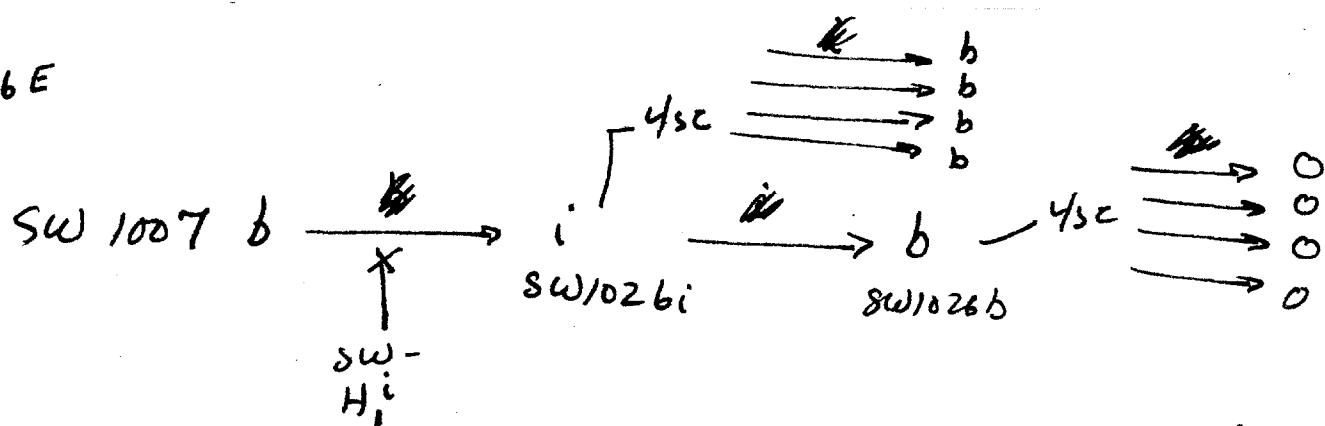
Other b's from SW1009 should be checked.

SW1026 is stated as FA12 (SW623)  $\rightarrow$  SW1007 (and not  $\rightarrow$  1009b)  
It was isolated in i phase, readily  $\rightarrow$  b, but the b phase  
(4 rotaries of 1 isolate) gives only  $z_{33}$ . The b phase has  
little or no  $z_{33}$ :

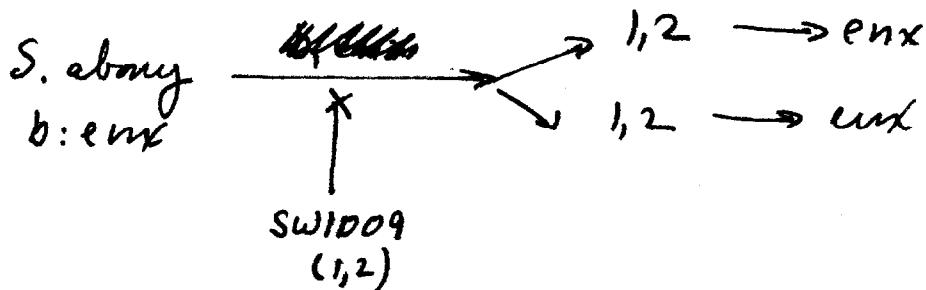
1036 H

- ① SW945 |  $1, 2^3$  | magnified though actually unstable
- ② 1000-C1 | 1, 2, 3 often not  $\rightarrow$  slow speed 1.2 $++$  1.5 - + at high speed  
original film seems good.  
1, 2 both  $++$  for main ph 2

1036 E



1036 D.



1038 B S. uncinii → b → 1,5  
 $a:1,5$       SW1007  
 $b$

D TM → b → 1,2 → b  
 $i:1,2$       1036 G-1  
 $b$

1038 E SW1007 → i → b  
 $b$       TM      SW1030

SW1009b → i → b      G, H.  
 $b$       TM  
 ditto  
 FA-10

(A)

TRANSDUCTIONS WITH <sup>(N25 AND )</sup>  
<sup>N97</sup> DERIVS. AS  
 RECIPIENTS.

Recip.	Phenotype (Inferred Genotype)	Donor (Gen.)	Prod.	Inf. Genotype. Lab.	
				(Genotype)	
1036E	SW1007 b	$H_1^b H_1^{1,2}$	FA10	$H_1^i i \rightarrow b \rightarrow o H_1^b H_1^i$	SW102
1038H	✓ SW1007 E ✓ SW1009	<del>b</del> $H_1^b H_1^{1,2}$	abomv TM	$i \rightarrow b$	SW103
G	✓ " "	b "	FA10	$H_1^i i \rightarrow b$	1038H
1046C ✓ N97	SW1043 b	"	TM	$H_1^i H_2^{1,2} i \rightarrow b$	1038G
1038J ✓ SW1026	i:b	$H_1^i H_1^b$	TM	" $i \rightarrow 1,2 \rightarrow i$	1046C
1049DE ✓ SW1031	a:b	$H_1^a H_1^b$	sendai	$H_1^a H_2^{1,5} a \rightarrow b \rightarrow a \rightarrow b H_1^a H_1^b$	SW103
1051G-H SW1053a	a:(c)	$H_1^a H_1^c$	Saltmndg	$H_1^c H_2^{1,5} c \rightarrow b$	(1) $H_1^c H_1^b$ SW105
SW1052				c → a (2) $H_1^c H_1^a$	SW105
SW1053c (c:a)	"				
1046G-3	<del>SW1049</del>		S. abomv	$H_1^b H_2^{env} \xrightarrow{env} H_1^c (H_1^a) H_2^{env}$	SW105
1046G-3 ✓ SW1049	i:1,2	$H_1^i H_1^{1,2}$	"	" $env \rightarrow a \rightarrow env$	SW105
K SW1043B2.2	1,2:b	$H_1^b H_1^{1,2}$	b:env	$\begin{cases} \text{Send } \rightarrow ? \\ env \rightarrow 1,2 \rightarrow env \end{cases}$	$(H_1^i) H_1^{1,2} H_2^{env}$
1046G			b:env	$\begin{cases} b \rightarrow 1,2 \\ b \rightarrow 1,2 \end{cases}$	$H_1^b H_1^{1,2}$
1074C ✓ N97	<u>b:1,2</u> alomv env		env → env	$\begin{cases} env \rightarrow b \\ env \rightarrow env \end{cases}$	$(H_1^{1,2}) H_1^b H_2^{env}$

SW1074.

1049G-3d <sup>extant</sup>  $\rightarrow i?$

N97... donors.

1038B	$1007b \rightarrow$ miami ✓	$b \rightarrow 1,5$	SW1028
1038D	$1036G1$ $N97b \rightarrow$ TM ✓	$b \rightarrow 1,2 \rightarrow b$	SW1027
1036D	$1009(1,2) \rightarrow$ abomy ✓ $N251,2 \rightarrow$ " ✓	$1,2 \rightarrow$ exx (2) " "	
1074A	$N97b \rightarrow$ miami n9 ✓		
B	<u>SW1043</u> $\rightarrow$ lamalind a exx ✓	$b \rightarrow$ exx	
1038K	$1026i \rightarrow$ miami	$i \rightarrow 1,5$	?
1046 D	$SW1031a \rightarrow$ SW1046	$a \rightarrow 1,2 \rightarrow a$ (2)	
E	b	$b \rightarrow 1,2 \rightarrow b$ (2)	

N251,2	$\rightarrow$ 666	$1,2$
	typis	$1,2$
	$\rightarrow$ miami	$1,2: 1,5$
	$\times$ abomy	$1,2: exx$
lathyr.	$\rightarrow$ TM?	
1,2-	$\leftarrow$ abomy	$b -$ and $1,2: exx$
	$\leftarrow$ TM	$i: -$

1036

D...

D.  $\text{g. abny} \times \text{FA50 (N25 1,2:-) (A)}$  → 1,2:enz<sub>2,2R</sub> of sw938  
 $\times \text{FA71 (N97 -:-1,2) (B)}$  → 1,2:enz

∴ sw1009 is also H<sub>1,2</sub>! The 1,2 phase should be studied closely, and  
 B. Recept. the reversibility to b confirmed.

Stock N97 received. Grow in b serum. Ht. phase grew out in 48 hours.

Stock acc. discarded. Recover sw1007 from unpurified inoculum  
 of 1036B1 back in 123 serum. This grew out fairly promptly.

sw1009 purified, s.c.i. in 1,2 serum → (about 3-4 days)  
 a b phase again. [Is sw1007 original N97 or ] (Apparent morphogenicity).  
 1036B2-6 are addnl. s.c.i. of sw1007 in (might be due to  
 b serum. 2-5 grew through in 3 days: all 2<sub>33</sub> b-2 cross-xx?

~~fasting~~

E. FA 12 (i:-) → sw1007 / b serum. growth: i: → b (sic!) 4/11 PM

F. sw1009 s.c.i. / 1,2, 3. 4/11 PM. Restrict each phase. sw1009 (over)

not ← 1 no g. in 24h. (poorly agglut.) → 36F2b b-  
 b (not 2<sub>33</sub>) 2 trubled through 24h → 36F2b b-  
 3 " " b-  
 4 " " b-  
 5 " 48h b-  
 6 " " b-

F1 probably just poorly motile to start

G = sw1009 / 1,2, 3 → b. (from stock sw1009, repetition of expt in B.  
 Test s.c.i. in b, cf. B2-6. Use one colony = G1 as stock for further  
 experiments, but 2-6 are separate colonies from the first plating  
 of 1009 / 1,2, 3. reversibly.

4/13 G7 = F2b, restricted, s.c.i. / b

4/14: G1, + + 2<sub>1</sub> = 1<sub>3</sub>, 4<sub>1</sub> + 6 animals)

(over)

The hypothesis that paraB javi might be

$H_1^{12}$ :  $H_2^b$  had occurred to me

(and PA sw1007, 01, was initially first)

just prior to reading the result of E!

---

	$b$	$\geq_{33}^+$	✓ reported 4/16.
sw1007	++	(or v. delayed)	

sw1009 b	++	++	<del>of sw1027</del> scd1009 = $1,2++$ $\geq_{33}^-$ $b^-$
∴ these are distinct.			

sw945, 1000c1	$1,2++$	$4/2 b++$ $\geq_{33}^-$
	$\geq_{33}^-$	

$G_3_0 \quad b + \geq_{33} ++ \xrightarrow{b} G_3, \quad b - \geq_{33} ++$

$G_2 \quad \text{u} \quad b - \geq_{33} ++$

$G_4 \quad \text{u} \quad b - (\geq_{33} ++ \dots)$

$G_7 \quad \text{u} \quad \geq_{33} ++ \quad b - \text{ (roughish)}$

$\frac{1}{11} G_1 \quad \text{u} \quad \geq_{33} ++ \quad b -$

SW1026 b:i?

1036E

4/12/53

E1. isolated from FA12 → SW1026/b in tube = SW1026  
 ↳ i serum. After s.c.i., to i serum for second phase.  
 After 3-4 days yielded further serum, reacting b!  
 For further verification, rectale SW1026*a* and SW1026*b* and  
 a) plant these colonies in homologous serum  
 b) rectake for further purif!

a) 1026 <i>a</i>	1/17 colonies	i++	b-
1026 <i>b</i>	1/17	b+++	i-

4/12 1036EA 1-4	4 <i>a</i> colonies positive / i → all four gave <u>b</u> in 2 hours. ↓ don't save
EB 1-4	4 <i>b</i> colonies first above. } (EB5-B = rectale) EB2      ↓ EB3      ↓ EB4      ↓ from EB-1 (min)
4/14	233+ b+ EB5 → 233++ b- EB2 → 233++ b- EB1 → 233++ b+ save 3,6      " " of 7038

That SW1026 is i:b is confirmed.

From the relative stability of EB series, the b phase seems to be more "fixed". (EB305-B).

✓ tube agglutination 1:1000 ~~was~~ i, b

i	++	i	b
-	-	-	++

(over)

(Also check SW674 above last).

1:1000 ~~1:1000~~ ~~1:1000~~  
++ +

PBE uptake  $\text{A}^2$

129...! determine other seroconverting.

It was noted that SW1009b (1036G1) reacted strongly with  $\geq 33$  as well as b, leading to further tests.

	b	i	$\geq 33$	1,2
SW1026 (i)	-	++	+	-
1026 (b) 36 (EB5))	++	-	+	-
1027 b	++	-	-	-

SW1007 and other isolates of SW1009b should be rechecked.

	b	$\geq 33$	
36F	1b	++	±
	2b	++	+
	3b	++	±
	4b	++	++
G1	++	±	considerable "quantitative" varieties. strains should be matched for more detailed comparison.
"1009b	++	++	(thought to be G1)

3/25/3 stock culture (#187 Edwards) appeared resistant to P22, but  
ff. one single colony isolate found sensitive (and smoother).  
(nasty mix. After purx  $\rightarrow$  (w) + .)

Attempt two FA pups (P122 - FA70,70A - from phage mix)  
70B from log.

But these pups. have no action on SW666 / mot. agar.

- A) 70A  $\rightarrow$  967: occasional plaques. May have strong lytic actions.  
B) 70A  $\rightarrow$  666 1? swarm-  $\frac{b}{(spont?)}$  on not agar; not apparent on  
no salt + E70B. (normal)

These pups have no salt + trans. activity for SW900 : presume  
negligible phage content

---

S. napolii ec'd from 187S (also #187). Plated out by opalit tube,  
and test individual colonies / P1722, ~~2~~ 2/11 showed  
distinct sensitivity. = 887 A1, A2. Prepare FA + P22, P7.  
lysability but no FA or phage!

Homologies of javin b.

1038

4/13/53.

- A. FA42 ( $sw942 = N25b$ )  $\rightarrow$  meini /a, 1,5 n.c.  
 B. FA73 ( $sw1007 = N97b$ )  $\rightarrow$  "  $b:1,5 \checkmark sw1028$   
 C. FA74 ( $103601 = N97b'$ )  $\rightarrow$  "  $c1: (2_{33}) : 1,5 -$   
 D. FA74  $\rightarrow$  TM ( $1035CD$  mix time) /i, b, 2  $\rightarrow sw1027$   
 $b:6,2 : b$  both  
 (not  $\cong 33$ )

Note previous experiments: (1000:

A	$sw88 \rightarrow 942$ (FA25)	4	1,2:-	Numerous swarms!	sw145
C	$abony^2 \rightarrow 942$ FA15	1	1,2:-	1000 c1 saved.	

Concluded at that time that  $N25b$  was homologous with  $*157\ 1,2:-$ . As these are macrophasic, and in view of C, the conclusion is unsafe. Selectability.

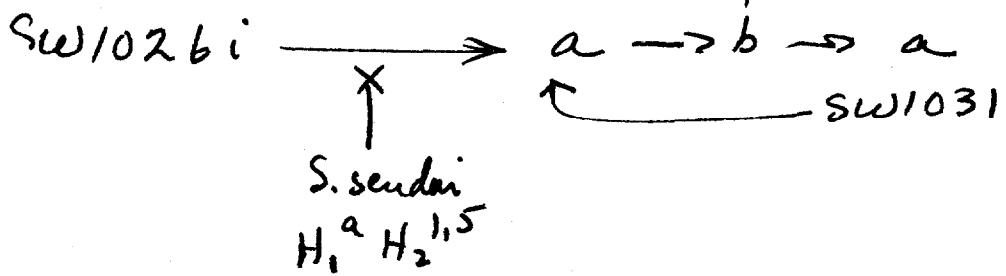
3/13. Make new PA preparations. 1031B1 appears to be resistant to FA10, 22 (sw22)  
~~sw1007-1009b, 942~~ are susceptible both. Beccles and Jusay are  
 succ. only to FA10. (possibility that this decay  $b:-$  is equivalent to  
 types of  $N97b$ ?  $N25b$ ? Kauffmann 248?)

D: hypothesis that  $sw1009b$  is  $H_1^{1,2} H_2^b$  is contradicted by finding  $sw1027$ , which  
 implies the homology of  $b$  in TM i.  $\rightarrow sw1007$  should be repeated, as  
 well as by C. For further analysis, the homologies of the  $b, i$  phases of  
 $sw1026$  will have to be examined via similar way.

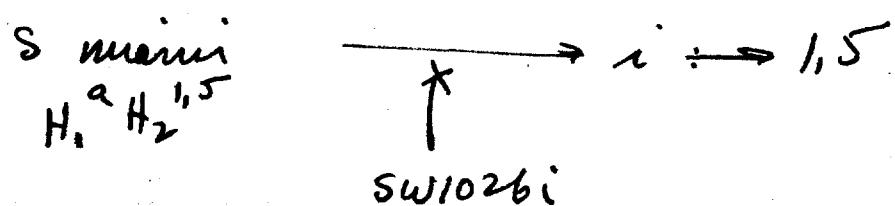
E	$sw107 \times$	FA22		$E1 \rightarrow i : b = sw1030$
F	" $\times$	10	2: both $\cong 33$	$G1 \rightarrow i : \text{[redacted}} (b)$
G	$sw109b \times$	22		$G2 \rightarrow i : \text{[redacted}} b$
H	" $\times$	10	1:	
J	$sw1026 \times$ serdoi (FA40)	1		<del>a:ext! sic hev form not</del>
K	$sw1026 i \rightarrow$ meini	$i : 1,5$	$\frac{1}{2} 2$	$a : b : a$ $sw1031$
L	" $b \rightarrow$ "		2 growth	Starts labelled J + is ext. Must
M	FA22 $\rightarrow$ sw942	i:-	v. slow progression after adjuv, seal off. $\rightarrow$ still $\frac{1}{2}$	assume substitution $\frac{1}{2} = 26812$ Save for H1? Type sometimes

"51" = env assumed contamination. Study as 33. Pure salt+. Pass through env  
 XI - nonviable in (i+1,2) serum.

1038 5



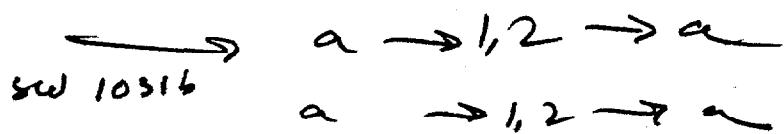
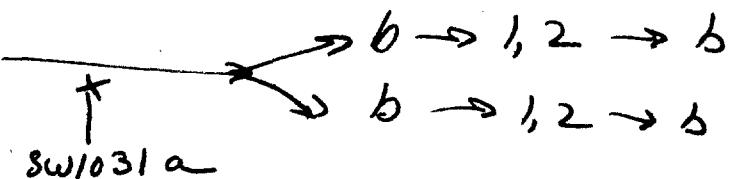
1038 K.

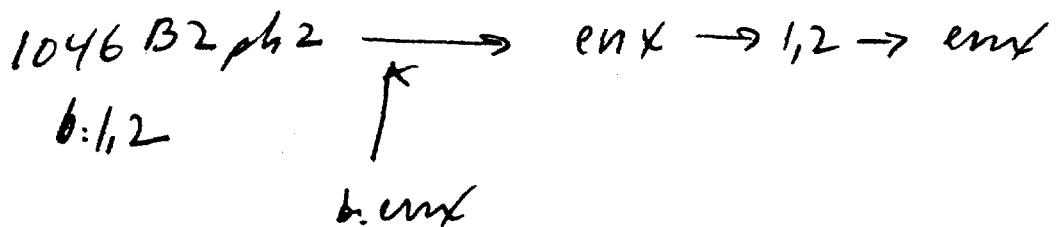
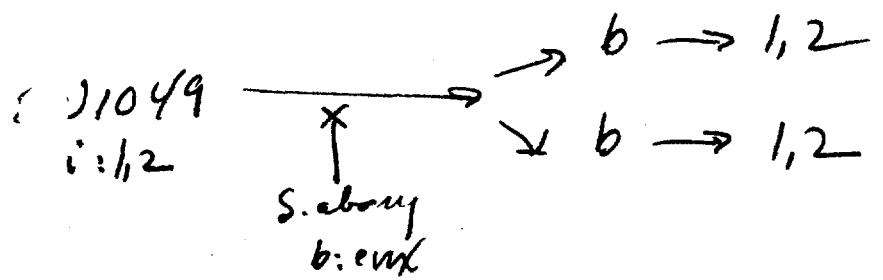


1046 C



SW1046





1049.

10385

SW1031 seems to be reversible  $a:b:a$ .

4/29. Retest

1. SW1031 b stock (one pern)

2. Second series, s.c.i from SW1031b:

$\xrightarrow{21\text{d}}$   $\xrightarrow{22\text{d}}$   $\xrightarrow{a}$  (after 3 days). Compare 1036F1

1 and 2L promptly gave an  $a$  phase again.

~~Test~~ 21, 22 to actual difference in possible

stability.

22 few light blbs  
2 days.

Assume that stock SW1031b is uniformly  $b:a$ .

Test 38521a in 1a for final reversal test.

5/6. } v. small blbs overnight.  $\xrightarrow{5/7} \xrightarrow{5/8} b$ .

5/12 } eventually swammed.  $\xrightarrow{5/12} \text{still } a$ .

Also, motility 521a, then into a (ca 5/9). By 5/12 still no progress.  $\xrightarrow{5/15} b$ .

Thus, SW1031 goes  $a:b:a:b$  (very sluggish).

- B.  $N97b \rightarrow S.\text{main} \rightarrow SW1028 \quad b:1,5 \quad \therefore b \text{ initially is } H_1^b$
- C. ditto  $N97b'$  but gene  $b_{233}^{xx}$ .  $\rightarrow S.TM \rightarrow SW1027 \quad b:1,2 \quad " "$
- M. TM  $\rightarrow N\cancel{25} \rightarrow i:-$  (so far).  $N25 \text{ possibly } \neq N97.$  }
- E-H TM  $\rightarrow N97b, N97b' \rightarrow i:b:-$  e.g.  $SW1030$   $\overbrace{\quad \quad \quad}^{\text{being checked.}}$
- J.  $a:1,5 \rightarrow SW1026 (i:b) \rightarrow SW1031 \quad a:b:a \quad \checkmark$
- K.  $1026i \rightarrow \text{main} \rightarrow (i:1,5):-$  worked  $\frac{1}{2} \therefore = \text{of } H_1^i$
- L.  $1026b \quad "$  n.g. indecisive. (cf. 1044)

~~need to repeat L; prepare FA from SW1030 a; b phases for homology tests.~~ 77

From previous results, 1,2 ( $N97,12$ )  $\rightarrow \text{main} \rightarrow SW1020$  was stable in 1,2,3 serum. (did not carry over likelihood of  $\rightarrow b_{233}$ ).

and  $i (SW1026) \rightarrow \text{main}$  (KI) was stable in 1,2,3.

If 1031 is reversible, prepare FA's.

L  
1026b  $\rightarrow$

FAT7 i,b  $\rightarrow$

3/14/53. Reisolate ~~TM~~, TM2<sup>1</sup> and<sup>2</sup>, SW950<sup>1, 2</sup>. f. 1035  
 Incubate for TM<sup>1, 2</sup> and 950<sup>1</sup> from slants; 950<sup>2</sup> from 1035 broth.  
 Also Reisolate a 950<sup>2</sup> from plating of prev. 950<sup>1</sup> ( $1/15$  colonies wanted)  
 i, 1, 2, 3.

1039(-)-1: TM2<sup>1</sup> a<sup>1</sup>  
 TM2<sup>2</sup> b<sup>1</sup>  
 950<sup>1</sup> c<sup>1</sup>  
 950<sup>2</sup> d<sup>1</sup>, d<sup>2</sup>. = 1039 d<sup>2</sup>

$\rightarrow$  5 colonies each i - 1, 2 ++  
 $\rightarrow$  " " " i ++ 1, 2 ++

Resuscinate motility (a-d) 1 and d 2 to initiate fresh media for transduction.

P16 exp't: All motility cultures react 1, 2.. ++, 1, 5 ++, 2: ++. c and d also react i ++ (delayed). This seems to bear out previous observation that SW950 is either phase-variable or phase-mixed. Resuscinate c1, d1 SW950 may thus be unsuitable for phase var. study.

1039 d<sup>2</sup>  $\rightarrow$  i 1, 2 colony  $\rightarrow$  20 colonies all i: 1, 2 ++ sal-

[Incubate i, 1, 2 SS. to attempt phase separation = 39 d<sup>2</sup>.] over.

abcd 3 = s.c.i. from 1035 ABCD. To 5 ml broth: slide agglutinations:

i	a	b	c	d	
1, 2	+++	-	+++	++	Try b+c.
	-	+++	-	+++	
					Gal+

p17. A FA14  $\rightarrow$  b+c (FA2+1, large lysis)

B FA15  $\rightarrow$  b+c (FA + 2 small lysis)

A. 38 swarms: all Gal-. all b++  $\#$  1, 3, 21, 22 env ±?

B. 25.

~~17 b all Gal~~ ~~(#1? b+ env ++)~~ Gal+

~~7 env all Gal+ #3, 5, 6 Gal-± (mixed - +)~~ mostly - +

of these, #8-16 were "most crowded swarms",

include 6 b: 3 env. (not noticeably different)

AB<sub>0</sub> (inc)

Gal- broth: all i++ 1, 2 - (was 1, 2 ± rough?)

Gal+ " : all i - 1, 2 ++

of SW950 which is SphaerX and efficient.

1039 d 2 /i → 1, 2, 3++ i++ (delayed) i.e. same as  
 original.  
 1039 d 2 /1, 2, 3 → i++ 1, 2, 3 - .  
 Selects similarly  
 to give pure  
 1, 2, 3 phase.

SW 414: s.c. from stocks. 5/33 tested with 1, 2 were ++.

These <  $\begin{matrix} 2 \\ - \end{matrix}$   $\begin{matrix} i- \\ + \end{matrix}$  1, 2++ (from the s.c.)

	1st test colony	sat	both	Removal to both	NSA plate
1	i - 1, 2++	-	all i++, 1, 2++	both	
2	i - 1, 2++	-		1, 2++	
3	i + 1, 2++	-		1, 2++	ditto
4	i ++ 1, 2++	-		1, 2 -	
5	i ++ 1, 2++	-		1, 2 -	

In general, i reaction stronger than both, 1, 2 from agar.

1039 e. Repeated: 4/15 1, 2++ i++. < <sup>NSA i++ 1, 2+</sup>  
both i++ 1, 2 -  
 from SW 414 stocks.

TM 2: 5/5 s.c. ~~both~~ → i++ 1, 2 - .

4/21/53

See 1039.A-B.

B

1-8 are Gal+ enx. Broths also react i:

9-25 are b Gal-.

streak out A: 1-8. S.C. react enx++ i - from agar.

	Gal	exp. #6a: b, i, enx, 1, 2 - pr +.	6b: enx ±
1	+		
2	9	+	
3	"		
4	"		
5	"		
6	20	+	
7	21	-	
8	21	+	

broth or. (= HLB #9) i+++ enx++

↓  
b.

S.C. broth 1-5, 8 are all enx++ i -

#6 is b. Original broth (HLB 39-25) is enx+++ b + i +

#7 is enx+++ i++. Reacts on EMBS Gal.

Original broths all stated to react somewhat i i.

Note: most unstable or mixed enx:i appears to reactive → See 950 (Gal-) of previous ex-x.

Purify original broths:

#6 = Gal+/- ca equal ratio. Test Gal-, + < -: b+++ 1, 2 - ) Save for stability check

#7 = pure Gal- 5/5 react strongly i enx from MB Gal. #3, 4 also i i.

Broth #1, 3 to broth. broths #1, 2

4/4 s.c. from #7 s.c. above, NSA, behave similarly (i- enx++).

Broth 2 to broth as 3, 4. → all 4 broths react enx++ i++). suspension from NSA magglut.

Cannot verify here whether i reaction is due to single variational instability. Save as 1041-7

4/25

4/26

4/25/53.

SW1033-5 rec'd from Edwards

See 1052

So rec'd:  
(by Edwards)

		a	cpx
A	1033	-	++
B	1034	+++	+ delayed.
C	1035	++	++ "

Residual for further experiments. Motility cultures as rec'd in homologous form,  
= A1, B1, C1. - no motility in 3 days in cpx, 9, 2 resp.

Sp motility not tested.

5/3/53. Received ETS26 and 41-D-1 from Army. Label single colony  
cultures as SW726A and SW1042 respectively.

Noz 726A in motility agar: essentially immobile 24 hours incubate.

SW1042 grows slowly, rather rough on plates.

726A appears smoother than 726 (Edwards). Aggregates strongly  
in cpx, ca 30-40% of cells in broth culture V. active. But swimming is  
delayed.

5/6 Noz 1033-1035 in motility also.

ca 5/2. SW1033 (s.c. but not motilized) —  
3 tubes each. ↗ FA22      ↗ FA18

42A 1 SW1033                5/8 —  
2                                1 tube { all 4 are  $\frac{a}{+++}$  (mat + cpx). Test is a S.S.  
3                                3 tubes ↗  
1                                2                                a :  
A2 —                        A2 —                        a  
A3(1-2-3)/<sup>1</sup> + 48h. → A3 { 1 — 5/26/53                A2 → a : ~~5/4/53~~  
A1                            few bbls.                    2 — 5/26/53                a : —  
3                                3 cpx                        3 — 5/26/53                a : cpx : a 5/18  
1                                ↗                                1, 2, 3 — 5/26/53                a : cpx :  
A2 → a : ~~5/4/53~~  
a : —  
a : cpx : a 5/18  
a : cpx :

PL 1052

a : — cpx  
5/18

1035-1039-1041

 $\text{Cal}^+ \text{Cal}^-$        $\text{Cal}^+ \text{Cal}^-$   $4/29/53\%$   
 $53\%$  <sup>Total</sup>

	$b: \text{enx} \rightarrow i: 1, 2$	3	43	0	0	all b
①	$b: \text{enx} \rightarrow i: 1, 2$	39	23	9	3	$\frac{12}{74} = 16\% \text{ enx}$
②	$b: \text{enx} \rightarrow i: 1, 2$	5		0		all b
④	$b: \text{enx} \rightarrow i: 1, 2$	0	0	21	4	all enx

①/3 and 3/4 show predominant role of FA, or

$$b^+ > 1,2^- \quad b^+ > 1,2^+ \quad \text{enx}^+ > i^- \quad \frac{\text{enx}^+ \leq i^+}{\text{in TM}} \quad \text{in TM}$$

③                  ④                  ②

note:  $i: 1, 2 \rightarrow b: \text{enx}$  general role of FA also,

$i^+: 1, 2 \rightarrow b: \text{enx} \rightarrow \text{mostly } i^+ \quad i^+ > \text{enx}^+ \quad ⑤$ .

$i: 1, 2^+ \rightarrow b: \text{enx} \rightarrow \text{mostly } 1, 2^+ \quad 1, 2^+ > b^+ ?$

contradicts ③

unless  $b: \text{enx}$  mostly  $\text{enx}^+ b^-$

if ⑤  $i^+ > \text{enx}^+$  and ②  $\text{enx}^+ \leq i^+$  designation?

4/25/53.

Rec'd sw1032 from Edwards as 2479-50. Reserve for further tests.  
Test culture as rec'd for motility, Mal fermentation, PLT22<sup>s</sup>

Streak out of both culture to EMB + Mal, two colony types were noted: top. Mal- and small Mal+.

These reacted similarly in fermentation tubes. Malt, however, was a coconus. In tubes, 24 holes:

Malt-	-
Malt	A
Malt,-	AG.

Resist all original stab culture. Rare + papillae noted. Resists and resistant to EMB agar, Mal.

FT72 → 1032 and 1032 → sw666 gave no motile.

5/2/53.

see 1029

A Gallinarum' → sw1040 /a  
= streak 74.

48h.-72h.  
1 ++ (gm) + = sw1041  
2 ++ " " = 1043A2  
3 -

B Pullorum' → sw1040/a

1 -  
2 -  
3 -

note: 74 did not grow on D(B<sub>1</sub>) agar. Typically gallinarum?

Prepare PA from other gallinarum, pullorum.

C. Gallinarum 1-10 and Pullorum 2-9 → sw666 +  
D. → sw1040 + a.

After 60 hours: C all -

D: G 2, 3, 4, 5, 7, 8, 10 are + to ++. P 2-9 all -. (typical G 1, 6, 9)

G 1 (severe)  
G 2 (gm)  
G 3 (gm)  
G 4 (gm)  
G 5 (gm) a  
as sent

G 6  
G 7  
G 8  
G 9  
G 10 (gm)

why are 6, 8 negative?  
streak out for S.

65 & others all gm.

↓

cultures were typed directly from swarms,  
then streaked out and (hastily) single  
colonies picked & rechecked. 65 is a as  
pointed out by PRE

repeat 6/2/53 ✓ → 65-2 (gp)+.

Control SW1040 a/a → no swarm 6/3/53  
T.O.

Transductions: TM, miami, abony.

1044

FA → B

A 1 S. miami → S. abony  
2  
3  
4 b:enx

a  
a  
15  
15

b  
enx  
b  
enx

]

No transducing tips.  
T.O. FA (22 miami)  
Repeat i FA 1b/miami  
5/3/53: still no  
swarms on  
b-enx.

B 1 S. miami a → TM  $i+1,2$   
2 " 1,5 "  $i,2$

C. 1 S. abony → S. miami  
2  
1 a:15  
b  
enx  
enx  
a  
15  
15

2/2 : enx.  
12/12 : enx  
1/1 : enx  
2/2 : enx + 1 enx + 1?

D. 1 TM2 → S. miami mixed.  
2 a:15  
enx  
 $i (22)$  }  
 $1,2 (18)$  }  $a+1,5$  7/7  
?  $\rightarrow$  not stiff? prot.

Also note v. small ~~to~~ blebs in C1 ; v. numerous tracks in C2, C1, mostly  
#1,2,4 still 1,5  
subsurface.

#3,5 possibly b (por aggl.) - streaks out

Tracks and blebs became very definite in C1

Two distinct swarms in C4:

10 Sept 1, all b

A2, A4 showed very dense surface blebs. ~~they were~~ <sup>A1, A3</sup> were smaller, less distinct  
Surface growth in C was rather sharply restricted. Moderate speed ~~on~~ on  
A, D, most on B.

Repeat C1: on a 1,5 agar 1 swarm → enx.  
a 5 several days: → 22/b: b = C5-  
same 1-8 all b: ⑤ #1 = SW1038.

Conclusion: 1,5 serum may inhibit b (colonies 1,5. - if K6...)

FA miami n.g? - female.  
(of 970).

(over)

more SW1038 in a:1,5  
inhibited for several days, finally  
grew out → still b.

E1 isolated from JL. 5/8/53. History from ca. 4/29  
ca 95% fatigue

E2 5/9/53 ca 30%. symptoms terminated.

typed: IX XII a: 1,5

susceptible to FA10

not to 22

sw1004: 22<sup>st</sup>.

both 44E1 and sw1004 heterogeneous ~~sw1004~~

E1. 5/8/53. History from 4/21±1. Symptoms most acute 4/29-30.  
almost negligible thereafter. ca 95% -

E2 5/9/53. ca 30% -

5/10/53: no PM sample obtainable.

5/11. E3. More sample directly in motility; in EMRS; on S-S.

EMPS ca 10% - var S-S - Shells. (few colonies from many stations of  
gravid E/2).

Stretch out firm mortality of E3 ( $E3\gamma$ ):  $\longrightarrow$  pure lac-

5/11 PM - mild headache + malaise (typ Sunday?)

5/12. v. wild d. friend. APPLEY → no lac+ in EMIB diint, state

His method may be advantageous. Test motility selection: → agglutinates in a serum. By combining it tetraethionate or butyl galactoside treatment pure bac-

5/13 AM s. mild symptoms continue / plate on EAGS, motility; S-S.

5/14 AMES noscript

*C. E. coli*  
types

5/15 AMEG  $\xrightarrow{\text{SS - } V. ranceolarios, \text{ incl. 1 block}}$   $\xrightarrow{\text{blocks along a}} \text{lact and EGA}$   
 $\xrightarrow{\text{EMB - ca 1% lac -}}$   $\xrightarrow{\text{other}} \text{lac- EGA}$   
 $\xrightarrow{\text{motility - fair progression}}$   $\xrightarrow{\text{a}}$   
 see EMB lac. pure lac -

5/16 · N ET: EMβ: pure fact  
Not so much → a

→ E5a { Lac - non-motile maggot. not succ. to Q3 Salm!  
E6a ↓ larvally, longer than normal. Malva or E745, glut

5/19 E8 - EMB product mat + Notility

SS - No swans seen ~~on~~ ~~at~~ to 5/27.

Lecanis aby a ++

(one)

E9. 5/25/53 1 lact + SS → nota → lact

E10 5/27/53 pure lact + in EMBA.  
SS - 3 colonies not a  $\xrightarrow{\text{in EMBLac}}$  pure lact.  
no further Salmonella?

E5a: eventually motile.

no motile papillae in EMBLac (10 days)  
but repeats  $\rightarrow$  no +.

E11 6/7/53. (7, 1d?? sync)

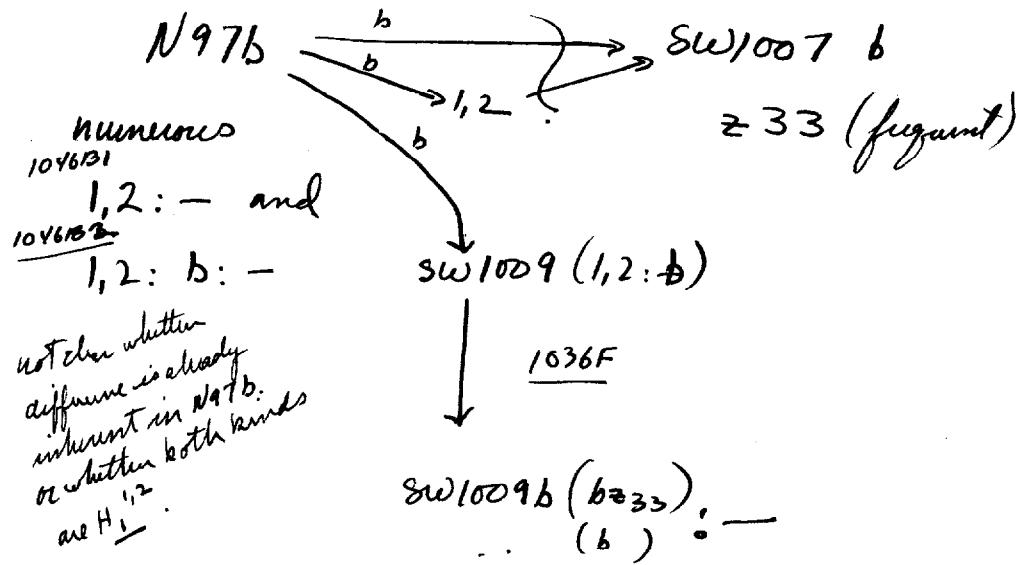
EMBLac - pure + two types: 13 mm?

SS  $\rightarrow$  pure lact / EMB Lac

Mot - irregular streams  $\rightarrow$

5/13.

$\begin{matrix} \text{m} \\ \text{b} \\ \text{semin} \end{matrix} \left\{ \begin{matrix} N25b \\ (\text{several}) \\ z_{33} \\ \text{#157} = -:1,2 \end{matrix} \right.$



~~X-TM~~       $i: -$        $i: 1,2$

1038G-1       $i: b$  ~~several~~       $i: b \rightarrow z_{33}$   
1038F       $a: b: a:$

$b: 1,2$       1038G-1       $b: 1,5$  (1038F)

$i: 1,2$   
 $\rightarrow$   $a: 1,5$

$1,2 \rightarrow b$ : error other features:

#157 :  $H_1^{1,2}$

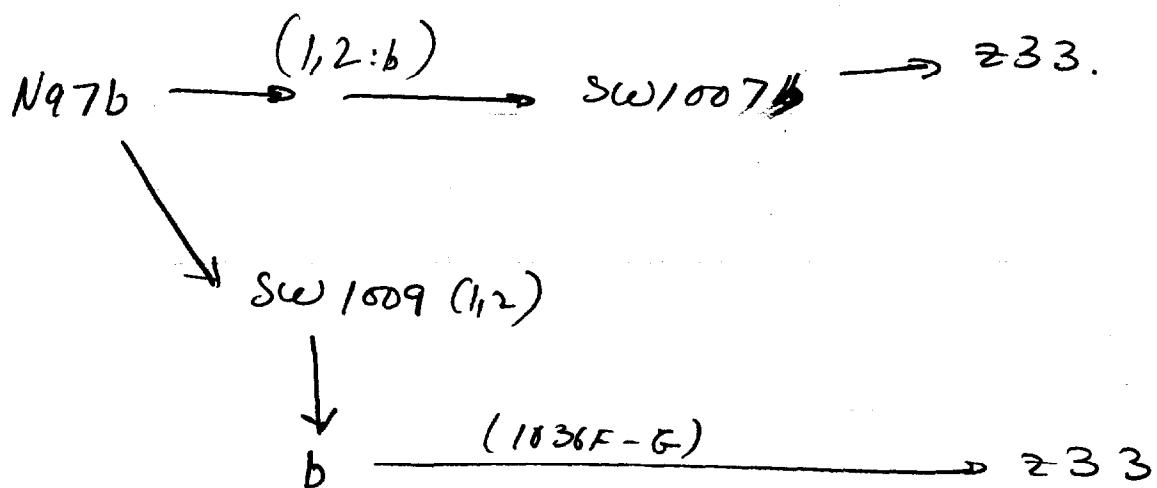
SW1009  $H_1^{1,2}$

$s . 031 \rightarrow TM \rightarrow b: 1,2$   
 $1026i \rightarrow \text{minim} \rightarrow i: 1,5$   
 (type?)

$\therefore$  SW1007b has behaved just like SW1009b (possibly excepting  $z_{33}X$ )

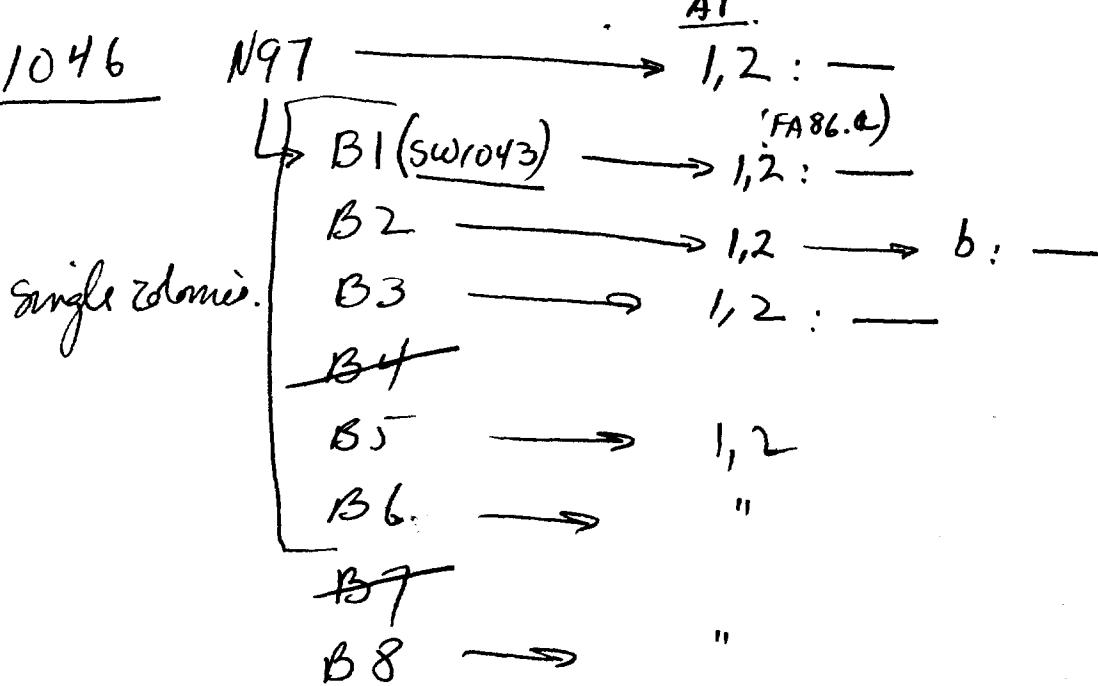
5/13

1036:



b                  1,2                  b.

1046



$\therefore N97b$  consistently  $\rightarrow 1,2$ . Some of these  $\rightarrow b : -$   
others are  $1,2 : -$

$86a \rightarrow 1022$  or above | FA (1046B2,2)

para A transduction

1045

25/11/53.

A SW928 bw → 1033 G 2  
B SW944 bw → 1033 G 2

numerous T+S.

see 1033, 1008

(over)

22 → 1033 G 2 s.c. 1, 2, 3 and oxygen) gave almost nothing: see tables...

Formation of better transduct of G 2 is left open. Compare A on s.c., and on SW 948.

3 days.

C. SW944 bw → S. paratyphi A SW701

D. " : " 702 / a

E. " " 694 (diagnos ~~XII~~ 2)

→ " " SW948 a<sup>+</sup> (1045B1 impor.)

no swarm

Repeat 22, 944 bw → ...

22 → 948 overnight  
G 2-1 ~~b~~ -

944 → 948 1-2 swarms

G 2 5-6

G 2-1 5-6

-2 15-20 num. teeths

-3 4-5.

Save G 2-2 as SW1048

246. 48h 5 da.

F. SW944 → 45B1 (par.) — " — 1045B1 should be transducible!

and controls

Check other similar isolates; might

G. FA22 → 45B1 — " — be rough.

45B1 / a — " — 5/26 — T.O.

→ 948

→ 1048

H...

SW944 bw. 1 swarm.

20-30 sw., numerous teeths.

SW967(60) 1 sw.

25 swarms teeths.

2 a

1 gnr

= 1045H1

SW1048 seems definitely more transducible by SW944 than SW948.

But affinity of FA22/2 still very low.

J. FA22 → SW1048 not allelic to SW666 or SW967!

SW944 → SW694 / a after 2-3 days. +

b:

K:

"

over

A.

18 strains all =

B.

36

29a

7b

prob. significantly different.

save a b as 1045B1

as sw / to 5/27.

On EMBS Xyl:

paper

SW701 grew poorly

+

702-694 moderately

?, ?

1048 fairly well. (in a few self lysed or rough colonies)

-

use Xyl as transduction marker? cf. sw702-694-948-1048.

5/3/53. Fresh culture of N97 (b) received from Edwards. = SW1043.

A. Broz in b serum asis. → after 24-36 hours a 1,2 phase (of 1036B). Save as 1046A1. overnight:  $\frac{1}{2}$  to  $\frac{1}{1}$ .

B. Stakeout. Broz single colonies in b serum. 1-8.

All but #6 spread in 24 hours → #1, 2, 3, 5, 8 all b-  
most 6 is not egan. (#4, 7 n-gr)  
(all killed)

→ in 48 hours → 1,2.

Save 1046B1 orig. as SW1043 (b) and stakeout #1 as SW1043(1,2)

SW1043 appears to differ from SW1007 in reactivity → 1,2.  $\xrightarrow{5/17}$

Why is N97 classified as b: -?

Prepare FA from each phase.

B1.12 /  $\frac{1}{2}$  → - (few small and  
B2 " /  $\frac{1}{2}$  → b: -  $\xrightarrow{5/17}$   
B3 " /  $\frac{1}{2}$  → - 1 trial  
eventually still 1,2

C. FA22 → SW1043 / b, 12

1.  $\xrightarrow{24h}$   $\xrightarrow{i: + 1,2}$  SW1049 = 1,2 ph.  $\xrightarrow{5/16}$   $\xrightarrow{233}$   
2.  $\xrightarrow{24h}$   $\xrightarrow{i: \pm \frac{1}{2}}$  3 days → 1,2.  $\xrightarrow{5/16}$   $\xrightarrow{233}$   
0 (control) —

sw1043"

D. SW1043.2 in 12 only small blbs. Repeat c motility of SW1043.  $\xrightarrow{5/16}$   
1046A1.2 " "

E. SW1031.b (kw) → 1046  $\xrightarrow{24h+}$   
" " a " → 1046  $\left\{ \begin{array}{l} b: 1,2 : b: \\ b: 1,2 : b: \\ a: 1,2 : a \\ a: 1,2 : a \end{array} \right.$

5/11/53 Repeat <sup>(3)</sup> a single colonies of B1 and B2 (original b) in b agar. F=131 G=132  
overnight: all -  
24-36 hours:  $\frac{1}{2}$  to ++

F1 P.M. 1,2 → 1,2 G1 5/14  $\xrightarrow{1,2}$  1,2 → 1,2  
F2 P.M. 1,2 → G2  
F3 5/14 1,2 →  $\frac{1}{2}, 2^{33}$  G3. 1,2 →  $b_2 \frac{5}{2} b_3$

for knowlbyg ret. J. abony (18) → SW1049 / i. 1.2  $\xrightarrow{5/16}$  b: 1,2  $\xrightarrow{2 days}$  all mor in 1,2 N/15. exc. 0 2  
K. " " → 1046 B2.2 / b. 12  $\left\{ \begin{array}{l} J1 b: 1,2 \\ J2 b: 1,2 \end{array} \right.$

→ K1 exx: 1,2: exx

X phage tests (for diplococci F6<sup>-</sup> tester) 1047

5/12/53

	X <sup>942D</sup>	X 942	sw	22	10	X
PB	703	—	±	+	++	
PB	704	—	±	+	++	
TM	714	—	±	++	++	
Stenley	715	++	++	—	—	motile
Hedelby	716	—	—	—	—	703
abony	803	—	—	—	—	704
TM	1046	—	—	—	—	sw 422
(one kind)	874	—	—	—	—	—
TM.	Miami	±	±	+	+	
typhi	LT-1	++	++	++	++	
	H901	+	+	—	—	
PA	701	—	—	±	±	
PA	702	—	—	—	—	

It may be feasible to adapt X to 703-704.

LT-1 seems most generally satisfactory of these. Possibility of adapting  
check motility: 703-4-14?

passes through motility.

5/12. Continue to mutant hunt using LT-1.

① Motivate motility agar for optimum sensitivity.

② streak out on NSA for single colonies.

③ streak out tests above (microscopically non-motile). ↗ 4/5 " motile

④ Motivate available auxotroph mutants of LT-1.

Note: 2 "LT-1" strains: cf. #84 and #306 TM1 = LT-1 (84).

sw 411, 422 may be presumed #306 strains.

LT-1 84	X
" 306	—
sw 202	+
sw 411	—

However sw 202 streaks quadratically on D<sub>10</sub> agar. Yields single colonies.  
↳ no prototrophs.

B. Take 20 s.c. TM1 motile in broth tubes, add diluted X. Incubate. streak out.

C. TM1<sup>for</sup> - 10 plates 9-10 sec. only 20-30 surv/plate. Repeat 8 sec.

(cont)

Prepare fresh X: add X/sw592 to T41 in 100 ml broth  
Incubate overnight. Filter (s heat). Test  
samples for sensitivity to chloroform, heat. Save  
( $60^{\circ}$  20 min.)  
aliquot in freezer also.

B. 4/20 were substantially mottled by muci. test.

"restable and test

May have had rare spinnars. #1 did not swarm out immediately  
directly on motility agar. #2-4 did (not homogeneously).

ignore these unstable Ffa<sup>-</sup> for the present

all other isolates here mentioned also swarmed out  
(sw103-4/X; 202/X; T41/X).

T.O.

C1: Test single colony.  $\rightarrow$  swarmed!

D: Plate T41 varnis dilution =

"1 ml X". At  $10^{-6}$  ca 100/plate 20 standard  
opt. single colonies in broth. 17 + 3 occ. spinnars  
no Ffa<sup>-</sup>!

5/17/53 ±.

(1) summarize HLB results.

(2). Add  $\text{NaNO}_3$  (.1, .2, .4 ml. 2% soln. per tube)

TG-  
not. sl. inhibition of spreading but growth considerably denser at each level.

Consider incorporation of .5%  $\text{NaNO}_3$  in basic medium (replace NaCl by  $\text{NaNO}_3$ ).

(3) Add Methyleneblue: (.1 ml of .1% per tube): distinct decoloration of bacterial spread, but substantial inhibition.

gas bubbles noted in HB and - tubes above; absent in presence of  $\text{NaNO}_3$ .

MB +  $\text{NaNO}_3$  inhibit in coarse; decoloration very slight.

5/17- (4). Tetrazolium ±  $\text{NaNO}_3$  (1)

(5) glucose to 1% ±  $\text{NaNO}_3$  (1).

	-	TG-N	TG	TN	NG	T	N	G
not.	+++	++ undecolor cause undecolor	++ undecolor cause undecolor	++ darker cause not colored	++ very dense yellow color	++ colored	++± darker growth	++ explod dense

5/19/53.

- A SW1031 a x FA3 (c) 2 tubes 1 → <sup>overnight</sup><sub>small bubbly</sub> SW1052 c:b:  
 B " b x FA3 (c) 3 tubes 1 → <sup>overnight</sup><sub>++</sub> SW1053 c:a:  
 C. " a x FA59 (l<sub>2,3</sub> to simulate wren). no swarms 48 hours.

Note #2 and #3 carried 1% NaNO<sub>3</sub>, and these did not swarm! See 1048.  
 nitrate did not seriously inhibit motility.

- D TMi (22) → S. wren / b last 2 tubes —  
<sub>(ew++ b+)</sub> no sw  
 E " → S. darw. ↓ swam (swam) 3 tubes <sup>no sw</sup>  
<sub>ew++ ew-</sub>  
 F " → S. sal. ates / ewx 1 → <sup>d</sup> 2 → <sup>d</sup>  
 G (= 10465...) d ± ewx ++  
abnormal (15c) → SW1049 i:b:1,2 / i, b, 1,2  
 H SW1026 i:b x FA59 (ref.C) still i.

- J SW1026 i:b x FA60 i=
- K " i:b x FA60. 1. magg. hatching  
 (d). May 10th (c)  
 L → 1 ewx / 1,2  
 2 " : 1,2 ~~ewx~~  
 3 " : 1,2 : ewx  
 4 " : 1,2 : ewx  
 5 " : 1,2 : ewx  
<sub>1st day 2nd delayed.</sub>
- ~~1,2/1,2 ewx~~ ewx / 1,2 ewx  
~~not swam~~  
~~magg~~ <sup>→ magg.</sup>  
~~i?~~ <sup>→ i++ b+?</sup>  
~~no sw. 4/5 f.o.~~  
~~i? (or rough?)~~ <sup>→ magg.</sup>

Note: SW926 and SW938 (1,2:ewx) each in both phases / 1/2, ewx not agn.  
 In 10 days, neither swarmed.

6/3. Rechecks 49G1d after mot + s.c.i.  
 6/4 " G5d

(over).

Retest possible *i* phases of 1049 & : 1, 3, 5...

G 3d is only culture to show definite *i*-vowels  
after metathesis. Results after s.c.i.

## Kinematics of dyskinetic paraB

1850

5/22/53 part type #

		FA 10	22	X	
A	1	B76	+	-	immobile both strobosc
B	2	B300	H	-	
C	3a	B62	++	++	
D	<del>3b</del>	B97	++	++	
E	BAOR	B2227	++	++	
F	3a I	B624	-	/	all strained more st.
G	Dundee	B3590			most distinct ++
H	Taunton	B2253	++	++	
I	Devon	234182	++	++	
		Bulles = B1742			

Isolate 1,2 phase; pure FA for  $\rightarrow$  a: enx  $\rightarrow$  motile broth  
Strain out 50A for origins of fla<sup>-</sup>.  
From initial 50A/X test

Firm initial soft / x test  
18 colonies on semi-solid.

Stretch out 50A for origins of fl's.

1 (initially) non-motile. Restreak + recheck.

swarmed later. Microsc: ~~ca~~ 1% motile cells  
and 1 armoring pair of cells  followed in gyrations 5-10 ms.  
(cf  $H_2$  x E - coli).

6/3 Note also FA from IV XII types for later study

AB#		A <sub>10</sub>	22
PB	7	S	R
	8	S	
TM	11	S	S
TM	12	S	SS
TM		SS	S
TM	159	S	S

should have  
fostered X also.

6/6 50H. 10 s.c.i. inoculated to 1 ml Penassay + V. after 24 hrs, 2d transfer.

9/10 : mostly immobile (entire also typed). 9/10 actively mobile.  
= 50%  
structure → not

1050A 10 s.c. in both + X. Broth, membrane  
stuck out, test 2 s.c. from each on mot agar:  
all F/α<sup>+</sup>!

Need to induce higher incidence of F/α<sup>-</sup>?

6/18 Repeat  
SOA-H → SLE10<sup>22</sup> /α: env

6/1/53.

A	$\Rightarrow$
C	$\Rightarrow$
D	$=$
E	$\rightarrow$
G	$=$
H	$=$

after remodifying, b - /  
 b T.O.  
 b

S FA 50 ( SW 546) =

R FA 2V (PB# 3 ph 2) -

$\rightarrow$  abnig / b: ext

most fields, no swim!! A, C, E magnet! Repeat. ↗

6/19/53.

A  
C  
D  
E  
G  
H  
K FA<sup>24</sup>  
L FA<sup>50</sup>  
D SCO<sup>71</sup>  
SW<sup>1057</sup>  
SW<sup>1058</sup>

→ SW 1022/9, env

× b : env : b  
b : env  
b : env

need a, b, env  
to express b.Save env phases  
(✓ after s.c.i OK)as 1050 A... N  
and b of 1050 A as

SW 1059

others T.O. 6/26/53

Each preparation therefore has some FA, but only b phase came through (any reason??). In previous experiments, FA<sup>50</sup> and FA<sup>71</sup> ~~12~~! Present seen may be questionable.

These results do not answer previous question of homology of the 1, 2 phases. Should be repeated one by one.  
homolog along-2.

7/5/53. Repeat → abnormal A, C1, L1... (3 each)

b : env

A - 1-3 L3 - grew through (still b); C1 - 3 no reg to 7/8.

L1-2 → 1, 2

L1 : b 12 env       $\xrightarrow{1,2}$  b 12' env  
      ++ -                  - - ++(7/11) not off limiting curves  
2/3 :

L2 : + ++ -      (delayed) - ++      s.c. ✓ 4 show weak, delayed b +.

5. sc show same

no 1, 2 + env strains.

no strain from L2 or L2'.